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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.  
ORIGINAL ARTICLES

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**Composition and Agricultural Value of the Arable Lands  
in the Argentine Republic.**

**Part II: Provinces of Cordoba, San Luis, Mendoza,  
San Juan and Santiago del Estero, and National Territory  
of the Central Pampa.**

by

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*Province of Cordoba.* — Bordering on the west the southern part of the province of Santa Fé and the northern part of the province of Buenos Aires, there is a vast extent of plains belonging to the province of Cordoba, which is in reality the continuation of that which forms the two adjoining provinces already described; that is to say that in the province of Cordoba in the neighbourhood of the two above-mentioned provinces the same kinds of soil are found. They are in fact loams, sometimes heavy; further off they become sandy and this latter character prevails in the whole of the south of this province.

The total area of the province of Cordoba is estimated at 42 000 000 acres while the plain extends for about 24 700 000 acres; the rest is taken up by the mountain masses of the north-west and some salt areas in the

the part adjoining the provinces of Santa Fé and Buenos Aires, an area including about 12 000 000 acres, it may be said that at present one-quarter is under wheat and maize; oats are not much grown and 346 000 acres are sown to flax. We give in Table IV the analyses of the good soils of this part of the province of Corboba.

The tenacity of the subsoil is inferior to that in the provinces of Santa Fé and Buenos Aires, and it diminishes still further in the part adjoining the latter province. The impermeable layer of "tosca" exists also in the rest of this plain, but in the eastern belt it occurs at a good depth (26 to



TABLE IV. — *Analyses of Soils. Province of Cordoba.*

	I		II		III		IV
	S Light brown	S' Yellow- brown	S Yellow- brown	S' Yellow	S Yellow- brown	S' Yellow.	S Yellow- gray
Fine gravel . . . . .	0	0	0	0	0	0	0
Coarse sand . . . . .	19.70	22.30	44.10	47.20	3.40	1.70	75.40
Fine sand . . . . .	69.60	66.00	45.50	43.70	82.80	78.20	19.80
Total sand . . . . .	89.30	88.30	89.60	90.90	86.20	79.90	95.20
Clay . . . . .	6.90	10.20	7.50	6.50	11.50	17.20	3.30
Humus . . . . .	1.00	0.20	0.90	0.40	0.90	0.50	0.20
Organic detritus and soluble matter . . .	2.80	1.30	2.00	2.20	1.40	2.40	1.30
Nitrogen . . . . .	1.46	0.62	1.37	0.76	1.53	0.95	0.63
Total lime (CaO) . .	7.92	8.46	9.66	10.42	7.03	7.92	8.29
Soluble lime . . . .	3.14	2.80	3.81	3.53	3.08	3.53	2.69
Potash (K <sub>2</sub> O) . . . .	5.74	4.32	5.98	5.51	6.82	8.64	3.80
Phosphoric acid . . .	1.39	0.97	1.27	1.18	1.78	1.52	1.03

Analyses: Nos. I, II: Eastern belt; No. III: South-Eastern belt; No. IV: Southern belt.  
S = Soil; S' = Subsoil.

50 feet); in the low-lying parts it comes nearer to the surface and sometimes crops out, holding up the water of more or less impure lagoons, all of them brackish.

In the higher soils, where the impermeable "tosca" bed is at a depth, the river water accumulating upon it forms an underground mass of water, which keeps the overlying ground in a state of permanent humidity very favourable to the development of plants possessing deep roots and especially lucerne; consequently this forage plant covers considerable extents of land (3 700 000 acres in the whole province).

The soil is of medium tenacity or light, and therefore very easy to till; it would dry out easily if it were not for the humus which it contains in large quantities, and which both increases the cohesion and helps to hold a certain amount of moisture. With a nitrogen content sometimes above 2.50 per 1000, these soils are very rich in potash and have also a high phosphoric acid content; the lime content is low, exceeding 10 per cent. only towards the mountains. These are very fertile soils, suitable for all crops.

In the rest of this plain, which is about 13 000 000 acres in extent, extends throughout the south of the province of Cordoba, the soil is generally sandy; soils with 10 per cent. of clay are rare, 7 per cent. being an average and in many cases it is as low as 3 per cent. The moisture in the subsoil due to the presence of the water table at a slight depth, already mentioned

as existing in the east of this province, continues to appear on a area on both sides of the Pacific railroad which crosses the southern of the province approximately from east to west. On travelling by this one is surprised to see the enormous extent, often as far as the eye can, occupied by lucerne and interrupted by wheat and maize, the two together occupying an area of about 3 500 000 acres.

From the above it will be seen that this is a region whose future lies mixed farming: breeding and dairying with cultivation of wheat and flax, latter prevailing on the heavier land towards the east, while on the west especially to the south stock breeding will prevail on account of the mess of the soil. In the whole of this plain fruit-growing gives excellent results.

A good deal might be said on the soils of the mountain region of this province, an important part of which is still covered by forests; these are noted in some localities, near means of communication, for charcoal for fence-posts; there are also considerable areas under cultivation. Some of these lands are irrigated, but a great deal more might be done by simple works which would allow the numerous watercourses descending from the mountains to be utilized. In general the soils are fairly calcareous. Fruit does remarkably well, both for quantity and quality; lucerne also thrives in these soils, which are indeed suitable for a number of crops, especially lucerne.

*National Territory of the Central Pampa.* — To the west of the province of Buenos Aires and to the south of that of Corboba lies the territory of the Central Pampa, which is a continuation of the plains described above, with soils similar to those of the neighbouring provinces; in general they are sandy and sandy, somewhat heavier in the part near the province of Buenos Aires; in the southern part, however, they are very sandy and often stony.

This vast territory, extending over 36 million acres, bears cereals on about 2 ½ million, chiefly on the land in the east and north-east which has more cohesion, but the full extent of the acreage which might be brought under cultivation is still difficult to estimate. The rest of this territory is almost all uncultivated; it is studded with numerous clumps of Algaroba trees (*Prosopis Algarobilla*) occupying areas of varying extent. Towards the west there are many salt soils; indeed this western half of the plain is within the arid belt of 200 mm. (8 inches) of yearly rainfall, under which agriculture would not be possible without the aid of irrigation; fresh water, both superficial and subterranean, is completely lacking, making it a region in which agriculture has a very limited future, and which is only suitable even for sheep breeding.

The other half of the Pampa gets from 200 to 400 mm. (8 to 16 inches) of yearly rainfall and only the north-eastern corner, that is, one of the parts that have been mentioned as the most fertile, is within the belt of 600 to 800 mm. (24 to 32 inches) which embraces all the south-west of the province of Buenos Aires and almost the whole of that of Cordoba. In this northern section, and perhaps also in other localities situated in the eastern

TABLE V. — *peryses of Soils. Pampa Territory.*

	I		II		III		IV		V	VI	
	S Light brown	S Brown	S Light brown	S' Light brown	S Yellowish brown	S' Yellowish brown	S Brown	S' Brown	S Gray	S Yellowish brown	S' Yellowish brown
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	62.20	24.10	30.70	32.80	33.40	34.80	57.10	59.40	76.10	81.00	79.50
Fine sand . . . . . »	27.20	66.00	59.80	56.22	54.33	56.22	37.23	35.59	17.80	16.19	16.94
Total sand . . . . . »	89.40	90.10	90.50	89.02	87.73	90.02	94.33	94.99	93.90	97.19	96.44
Clay . . . . . »	7.70	8.00	8.30	8.60	10.30	8.60	4.00	3.90	2.94	2.20	2.80
Humus . . . . . »	0.70	1.30	0.60	0.60	0.60	0.60	0.50	0.30	1.00	0.10	0.10
Organic detritus and soluble matter . . . »	2.20	0.60	0.60	1.78	1.37	1.78	1.17	0.81	2.76	0.51	0.66
Nitrogen . . . . . %	1.91	1.50	0.70	0.91	1.09	0.91	1.23	0.52	0.52	0.38	0.32
Total lime (CaO) . . . . . »	7.96	10.66	10.44	17.47	12.77	17.47	16.86	25.77	12.71	9.38	11.31
Soluble lime . . . . . »	3.53	5.04	4.69	10.22	5.81	10.22	7.98	16.73	5.68	2.73	3.57
Potash (K <sub>2</sub> O) . . . . . »	4.48	6.15	6.32	3.74	3.67	3.74	3.77	3.40	3.08	2.21	2.35
Phosphoric acid . . . . . »	1.52	1.69	1.30	1.24	1.49	1.24	1.28	1.05	1.11	1.09	1.07

the Pampa, the judicious application of dry-farming methods on the sandy soils might yield some results, but they ought to be combined with natural wind-breaks (such as rows of trees) in order to diminish as far as possible the violence of the prevailing dry winds and the excessive evaporation which they cause in these very loose soils; the windbreaks also prevent within certain limits the blowing away of these soils, thus maintaining cohesion and kept loose by the repeated tilling which is the basis of this system. Up to the present no experiment has been made to throw light on this interesting subject.

In the subsoil of the Pampa the layer of "tosca" also occurs as in the neighbouring provinces, but in general only at a slight depth, which contributes to render farming often problematical even in the best (1). Table V shows analyses of soils from this territory.

*Province of San Luis.*—The characters of the western half of the Pampa do not prevail in the southern part of the province which borders it to the north, namely San Luis, and on an area which may be roughly estimated at 2 ½ million acres. This province, the total area of which is 18 258 000 acres, is situated to the west of the province of Cordoba; in the centre of the northern part there is an important group of mountains separated from the above-mentioned province by a broad valley which in its turn is bounded on the east by the Sierra de Cordoba running north and south and forming the boundary between the two provinces. This valley is furrowed by numerous small streams descending from the neighbouring mountains; it offers to farming, or rather to stock breeding, an area of about 100 000 acres; to this may be added an extension towards the south as far as Rio Quinto, which starts from the south end of the mountains and runs in a south-easterly direction to lose itself in the south of the province of Cordoba; the whole area amounts to 1 250 000 acres.

The soils of this plain are somewhat different from those hitherto described (see Table VI). They are for the most part light and very permeable, with a rather high lime content, sometimes reaching 50 per thousand; they contain small quantities of gypsum and are rich in potash, well provided with phosphoric acid and frequently fairly rich in nitrogen. They rest on a subsoil very nearly resembling the soil, and the content of sand increases with the depth until the water-table is reached. This is situated at a considerable depth below the surface, but often sufficiently near it to be able to keep the subsoil moist, which greatly favours vegetation. Where sufficiently moist, these soils are excellent for Leguminosae in general; lucerne grows luxuriantly and almost indefinitely (2).

Continuing towards the south, but always in the part adjoining the province of Cordoba, the soil becomes more and more sandy with a clay content between 7 and 2 per cent. It is fairly rich in lime, but poor in nitrogen. On account of the scanty covering of natural vegetation; nevertheless in some localities and for considerable extents lucerne thrives very well.

Nevertheless lucerne is grown on nearly 2 million acres. It occupies about 450 000 acres.

TABLE VI. — *Analyses of Soils. Province of San Luis.*

	I		II		III		IV
	S Yellow- brown	S' Yellow- brown	S Gray	S' Gray	S Yellow- gray	S' Yellow- gray	S Reddish- gray
Fine gravel . . . . %	0	0	0	0	0	0	0
Coarse sand . . . . "	38.20	37.70	50.10	49.90	53.50	50.40	77.50
Fine sand : . . . . "	48.00	49.04	38.10	39.60	34.60	37.10	19.30
Total sand "	86.20	86.74	88.20	89.50	88.10	87.50	96.80
Clay . . . . . "	11.50	11.10	9.00	7.60	8.90	9.10	2.40
Humus . . . . . "	0.90	0.60	0.90	0.50	0.70	0.70	0.10
Organic detritus and soluble matter . . "	1.40	1.56	1.90	2.40	2.30	2.70	0.70
Nitrogen . . . . . ‰	1.71	0.98	1.32	0.87	1.45	1.44	0.56
Total lime (CaO) . . "	10.89	15.68	13.47	22.79	22.09	25.26	10.39
Soluble lime . . . . "	5.60	9.80	11.34	18.82	16.80	19.94	1.68
Potash (K <sub>2</sub> O) . . . . "	9.06	8.74	8.00	7.10	8.08	8.64	2.99
Phosphoric acid . . . "	1.62	1.49	1.59	1.54	1.69	1.73	1.15

Analyses: Nos. I, II: North-eastern region; No. III: Eastern region; No. IV: South-eastern region.  
S = Soil; S' = Subsoil.

owing to the moisture of the subsoil, due as in the northern part to proximity of but slightly saline subterranean water.

This eastern part of the province of San Luis, bordering on the Cordoba, is about 3 450 000 acres in extent; with the plain described above, this makes a total area of 4 700 000 acres, all of which is situated in the rainfall belt of 400 to 600 mm. (16 to 24 inches); but owing to extreme permeability of the soil and the prevalence of drying winds, the soil soon dries out, so that plants suffer from drought in the non-irrigated parts, which are by far the more extensive. These dry areas are covered by stunted shrubs (*chañares*, *Goullia decorticans*) which produce the sparse and tough grass which grows there against the scorching sun. In these poor pastures sheep are bred, while in the moister lands provided with more abundant vegetation cattle and mules are grazed.

In the mountainous region, an important extent of which is irrigated, there are also some very good soils and fertile valleys in which irrigation is possible; the atmospheric precipitations are more abundant than in the neighbouring plains, and consequently vegetation is more vigorous.

All the belt to the west and south-west of the mountain range is arid and partly saline; the want of fresh water renders any attempt at farming impossible, especially as the climate is still drier than that of the east of this province.

*Province of Mendoza.* — Continuing still towards the west one enters province of Mendoza, separated from that of San Luis by the Rio Desaguadero flowing almost due south. The waters of this river are unfortunately salt and unsuitable for irrigation or for watering live stock. This province has an area estimated at 36 160 000 acres, but notwithstanding good quality of the soil which forms the plain stretching from the above to the foot of the Andes, only a small proportion of its acreage is in cultivation; this is due to the extremely dry climate, which does not allow of any farming without permanent irrigation. The western part of this province is occupied by the chain of the Andes, up to the summits, which form the frontier between Argentina and Chile; all the mountainous part is arid with the exception of an occasional uninhabited valley watered by a stream and used as pasture for stock; the rest is absolutely bare of vegetation. From the immense glaciers of the Cordillera descend numerous torrents, which combine before issuing into the plain to form several important rivers; the largest of these is the Rio Mendoza, whose waters, particularly abundant during the hot season, are to a great extent utilized for irrigation, supplying most of the land at present cultivated in the province.

In the plain bordering the Rio Desaguadero, which extends for a width of sixty to seventy miles, there is no cultivation except on a strip of land running across the province on each side of the Pacific railway, where the waters of the rivers Mendoza and Tunuyan are made use of.

In this plain the soil is sufficiently calcareous, and contains also considerable quantities of gypsum; it is well provided with other elements of fertility except nitrogen, which is deficient on account of the scantiness of natural plant covering. The soil, 8 to 10 inches deep, is generally loamy, sometimes sandy; the subsoil is almost always more sandy and at a greater depth becomes pure sand, which in its turn rests on a stratum of small pebbles of considerable thickness. Over such a permeable formation, the volume of the streams descending from the Andes naturally diminishes rapidly, and they completely lose themselves at a relatively short distance in the Cordillera; this circumstance greatly reduces the importance of the irrigable belt. Like the adjoining country of San Luis, this vast plain is partly covered by shrubs (*chañares*); it contains also, especially towards the north, considerable saline areas.

In the portion near the Pacific railroad, water is found at a small depth (15 to 30 feet), but it is almost always more or less brackish. As the plain of Mendoza is approached, following the same railway line, the character of the soil changes sensibly; there is a large extent of alluvial deposits of rather calcareous nature, generally more so than those forming the plain; the soil is also more compact, being somewhat heavy, or at any rate loamy, and contains a clay content attaining 10 to 15 per cent.; this land is permeable and easily cultivated. The depth of soil varies between 12 and 32 inches; the subsoil is more sandy and often rests on gravels, under which, as in the plain, there is a pebble bed of great thickness. (See Table VII).

TABLE VII. — *Analyses of Soils. Province of Mendoza.*

	I		II		III		IV		V		VI
	S Ve oish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Yellowish gray	S' Yellowish gray	S Reddish gray	S' Reddish gray	S Yellowish gray	S' Yellowish gray	S Gray
Fine gravel . . . . . %	0	0	0	0	0	0	0	0	0	0	0
Coarse sand . . . . . »	51.51	58.56	70.88	55.39	63.45	76.81	61.85	75.51	81.25	83.86	75.40
Fine sand . . . . . »	34.07	29.04	18.28	30.58	29.58	18.96	28.50	16.10	13.30	11.75	21.72
Total sand . . . . . »	85.58	87.60	89.16	85.97	93.03	95.77	89.35	91.61	94.55	95.61	97.12
Clay . . . . . »	12.20	10.82	8.40	11.55	4.28	2.50	8.21	6.00	2.96	2.72	2.20
Humus . . . . . »	0.15	traces	0.20	0.15	0.50	0.50	0.20	0.10	traces	traces	0.10
Org. detritus and soluble matter »	2.07	1.58	2.24	2.33	2.19	1.23	2.24	2.29	2.49	1.67	0.68
Nitrogen . . . . . %	1.05	0.84	0.70	0.56	1.40	0.60	1.81	0.49	0.30	0.24	0.36
Total lime (CaO) . . . . »	41.21	31.19	45.58	33.54	25.14	25.20	13.61	12.18	20.72	22.79	22.45
Soluble lime . . . . . »	25.10	20.23	26.13	19.60	18.30	17.42	6.58	10.86	14.56	16.73	6.79
Potash (K <sub>2</sub> O) . . . . . »	5.34	5.32	4.28	4.95	4.32	3.98	3.65	3.92	3.46	3.86	5.72
Phosphoric acid . . . . . »	1.02	1.76	2.83	1.96	1.73	1.34	2.02	1.60	1.46	1.34	1.65

Vine growing is extraordinarily developed in this province, where the conditions are extremely favourable to it. Soil and subsoil suit the vines and these give high yields without manuring. The average yield is 5 and even 8 tons per acre, and what is very important the dry climate protects the vines against the attacks of fungus diseases. It is the important vine-growing centre of the country; at present it embraces 150 000 acres (1) of vineyards, of which about two-thirds are situated on the alluvial land described above; this part is irrigated by water from Rio Mendoza.

Further south, but still following the foothills, the soils become gradually sandy, and are cultivated only where irrigation is possible; they are vineyards, fields of lucerne (2) and grassland devoted to breeding and the keeping of the mules and horses required for the wine industry. During the last few years fruit growing has made a vigorous start and is to develop from year to year; olives especially give good results. It is a region with a great future before it; its cultivable area cannot be estimated at present, as it depends upon the irrigation works to be made, both the completion of those at present existing and to tap the other streams run into it. Some important colonies have been lately founded and they are prosperous. Fruit growing is mostly practised and also sylviculture, important works are being carried out with the object of increasing the arable acreage.

*Province of San Juan.* — Conditions of climate and soil closely resemble those described above and are met with in the neighbouring province of San Juan, situated to the north of the province of Mendoza. The area of the province is estimated at 21 563 000 acres, but it is very mountainous; the soil in general is sandy and its subsoil very permeable, so that no cultivation is possible without irrigation. Only the bottoms of some valleys are irrigated by the presence of streams are cultivated; unfortunately these courses are of no great importance, except of course the Rio San Juan flowing by the town of that name, situated in the south of the province and near the Cordillera.

It is thus in a belt of relatively small extent round the town that most of the cultivated land lies; this is especially given up to vineyards, which, though they do not cover an area as extensive as those of the province of Mendoza, yet follow them immediately in point of importance in the country.

These vineyards occupy an area of 75 000 acres; they produce wine and raisins. Fruit growing is also beginning, but it does not seem destined to develop to the same extent as in the neighbouring province of Mendoza. As a whole it is not a very populated region, but one which tends to develop considerably from an agricultural point of view within the area available for irrigation, which will always be relatively restricted, owing to

(1) In 1887 the area of the vineyards was 11 660 acres; in 1909 it reached 74 630 acres and at present it is 150 000 acres, which yield about 88 million gallons of wine.

In this province 230 000 acres are under lucerne.



the small amount of available water ; further the extreme permeability of the soil and subsoil necessitates abundant and frequent watering (1).

*Province of Santiago del Estero.* — Lastly, in order to complete the description of the immense plain which forms the most important part of Argentine from an agricultural point of view, there remains to be mentioned the province of Santiago del Estero, situated to the west of the province of Santa Fé and to the north of that of Córdoba. It is a considerable area of plains (35 250 000 acres), traversed by a few watercourses, of which the two most important, the Salado and the Dulce or Saladillo, run parallel to each other towards the south-east.

In the whole province the only interesting part is that lying between these two rivers or near them. In the south-west are enormous salt deposits and salt lands, and the same occurs also in the north-east ; they are almost desert, on account of the want of fresh water on the surface and in the depths of the soil. The climate of this province is dry and the scanty rains fall during the summer from the end of November to the beginning of March when the temperature is often excessively high.

The arable land of the part mentioned above as the best, consists of the most part of deep, light or loamy, sometimes somewhat heavy soils ; the subsoil does not differ much from the surface soil. The composition varies from place to place : in the more humid parts occur soils rich in lime and nitrogen ; their lime content is frequently high (10 to 50 per cent and sometimes even more), but a singular and general feature is their richness in potash, which is rarely below 5 per 1000 and reaches as much as 12 per 1000, while in many soils it is between 8 and 10 per 1000 ; it is the same with phosphoric acid, which rarely falls below 1 per 1000 and attains 3 per 1000, in many cases ranging between 1.50 and 2.35 per 1000.

This region is thus not without some very interesting soils, but it is impossible at present to estimate their extent ; they are unfortunately intermingled with more or less salty areas which would require a special treatment to eliminate the excess of soluble salts they contain ; this would be possible only by means of irrigation. It is in this connection that a difficulty arises, since the waters of the two rivers, the only available ones, are rather unsuitable for this purpose, throughout the whole of their course they gradually get charged with chloride and sulphate of soda, of which salts they already contain a certain quantity on entering the province.

(1) In spite of this there are already 136 000 acres of lucerne.

## The Testing of Calculation According to Kellner's Starch-Values in Practical Feeding in Germany

BY  
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Calculation according to starch-values had its origin in Germany and the method is less known to the agriculturists of other countries, for which I will first give a brief account of the principles of this system of calculation.

The important bearing of the laws of energy upon the physiology of nutrition was recognized from the results obtained by RUBNER in Berlin and WATER in the United States, and was also confirmed by other investigators. Further, O. KELLNER followed in an admirable manner the mutation of energy which takes place during the assimilation of food in animals, especially in the case of oxen during fattening. N. ZUNTZ and his fellow workers have turned their attention to the relation existing between food energy and the amount of work done by horses.

Animals take up chemical energy with their food. Those portions are those which pass through the intestines and are ejected, as are also the excreta which are removed by the urine in the form of incompletely digested organic compounds. We may designate as "gross energy" the energy content of the food minus the energy content of the excreta, urine and the intestinal gases. In order to obtain the "net energy" from the "gross energy" it is necessary to make several deductions from the former, in particular for the work of chewing and digestion, including the mechanical work of taking in nutritive substances, and impelling indigestible substances through the digestive canal. In the case of ruminants, in which this is of especial importance, the chief loss is caused by the crude fibre of the food; for each kilogram of crude fibre eaten, an expenditure of 60 calories is necessary on an average; and the energy content of the portion of the food is decreased by this amount. The net energy available to the animal in the maintenance of life, especially in the movements of the heart, lungs and the various body muscles, as well as for the conversion of vegetable food into animal substance, *viz.* the transmutation of carbohydrates into fat, and of protein into flesh, blood, etc. Part of the net energy is also made use of by the bacteria living in the intestines and the rumen.

Whatever net energy remains to be of practical use to the agriculturist, we call "stored energy", *i. e.* all the energy which is laid up in the form of flesh, fat, glycogen, etc. Milk can also be reckoned in, for as is

well known, this is made from certain substances taken up by the glandular cells of the udder (with the assistance of the nerves) from blood and the lymphatic vessels, and which temporarily serve to build up the gland cells.

The work of science is to ascertain how much of the gross energy the food passes over into "stored energy". In this direction, O. KELLNER has done prominent work as regards the fattening of adult ruminants. It was doubtful as to the best word to be chosen for the use of the practical farmer to express the ascertained "stored energy". The educated farmer knows the meaning of starch, fat, protein, etc., but Kellner considered the term "stored energy" ("Ansatz-energie") would be beyond comprehension and chose another way of expressing the idea.

In fattening, fat is made from starch, about 2360 energy values (calories) being stored up in the body for every kilogram of starch taken up. Kellner took the number 2360 as a unit, called it  $=1$ , and gave it the name of "starch-value".

The amount of energy derived from protein, fat, sugar, etc., and stored up in the body can be referred to this unit, and in this manner starch-values of the various other nutritive substances and feeds can be calculated. For instance, 1 kg. of digestible protein has in fattening a starch value of 0.94, and 1 kg. of fat in oil-cakes has a starch value of 0.1.

M. RUBNER had already ascertained that digestible food stuffs are dynamic, and that every foodstuff can be reduced to a unitary basis by calculating the energy value (calories). Further, it is necessary to pay attention to the amount of the digestible protein, for this cannot be replaced by fat and carbohydrates. In addition to ascertaining the starch-value ("Ansatz-energie"), it is thus necessary to be sure that a certain amount of the starch-value exists in the food in the form of protein.

a) *Fattening with regard to starch value.*

A number of fattening experiments with oxen and pigs were carried out under the conditions obtaining in practical farming, definite number of starch values being fed. Oxen were undertaken by G. ANDRAE at Braunschweig and W. SCHNEIDEWIND at Lauchstädt. Pigs were dealt with by J. HANSEN, W. SCHNEIDEWIND, THIELSCH and others. The reports show without exception that the rations determined according to Kellner's starch-values were correct, and that this method of reckoning the amount of food required was preferable to all other systems.

This practice will become more general in Germany in the future than it has been hitherto.

b) *Feeding of milch cows with regard to the starch value of the feed.*

Of late years, the Control Associations have taken a leading position in Germany respecting the feeding of milch-cows, as far as the application of scientific experience to practical methods of agriculture is concerned. Some of these Associations calculate according to starch-values, others according to "food units". The last-named method was adopted from Denmark and Sweden, and is based on the work of FJORD and PEDERSEN at Copenhagen; these workers ascertained that a milch-cow must consume

am of rye, rye bran or wheat bran, in order to produce 3 kilograms of Forother feeding-stuffs similar results were worked out, giving sub-figures for rye etc.; the amount which was equivalent to 1 kg. was called a "food unit". The amount of many foods which constitute a food unit has since been altered as a result of practical experience, after Kellner made known the starch-values. The differences in starch values and food units have now been adjusted. The value is: 1 food unit = 0.605 starch-value = 1430 "stored energies". There is therefore no reason to retain in future the term food unit (which is only used in one part of Germany). For my part, I should suggest in the different feeding systems the number of "stored energies" to be internationally substituted for starch values (which were used for calculating the increase in fat during the fattening process). Most of the Control Associations in Germany reckon according to starch. Further, numerous feeding experiments under the conditions of practice have been carried out on the basis of starch-values, viz. of J. HANSEN, G. ANDRAE, THIELSCH, VON KNIERIEM and BUSCH-MORGEN, BEGER, WESTHAUSER. All agree that reckoning starch- ("Ansatz-energien") is far more satisfactory than the old method of calculating from digestible food materials.

Those practical farmers in Germany who carry out such calculations, use of starch-values or food units; they reckon therefore, though for the part unconsciously, according to stored energies, since these three methods of calculation are comparable with temperature returns on the thermometer, Fahrenheit and centigrade scales. The figures given are different, the same amount of heat is expressed; in our case, the amount of energy is equal, but the figures are different.

With regard to the feeding of milch-cows, there is still a difference of opinion as to what proportion of the starch-values must be given in the form of digestible protein.

Formerly WOLFF and MÄRCKER reckoned that a cow must consume 100 gms. of digestible protein to produce 1 kg. of milk. KELLNER in 1905 needed the amount at from 60 to 75 gms., and from 1906 at only 45 to 50 gms., the smaller amount in the case of lower, and the greater in that of higher, milk yield. The Swedish, Danish and Schleswig Control Associations calculate, according to the proposal of NILS HANSSON, 45 gms. of digestible protein for every kg. of milk, without any regard to the amount of milk produced. Each cow receives in addition as maintenance ration 325 gms. of digestible protein per 500 kg. of live-weight.

NILS HANSSON in Stockholm rightly points out that the experience recorded by Kellner respecting the protein required in fattening cannot be applied in the case of milk production, since greater transmutations of substances and energy take place in transforming food protein into flesh than in transforming it into nitrogen containing connective tissue. In the latter case, the molecular

redistribution is less and the food protein is utilized better. This coincides with the results obtained by JORDAN at Geneva (New York) found that when the food contained little protein 90 to 95 per cent of quantity over and above that required for the maintenance of the animal was transformed into milk, while with larger quantities of food protein, less of the latter was used for the purpose of milk production.

According to the wide experience of the Scandinavian Control Commissions, it would be highly desirable to diminish the amount of protein prescribed by Kellner, unless any special reason exists for giving a large quantity. From the practical point of view the matter is of importance in that protein is an expensive food material. It must be decided independently the general question as to whether reckoning according to starch-value proved satisfactory. This question can, without doubt, be answered affirmatively for Germany.

## Trials of Agricultural Machines in Sweden

by

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### HISTORICAL.

The first official trials of agricultural machines made in Sweden were organized by the Royal Academy of Agriculture, which celebrated its centenary in 1913, and by the societies of Rural Economy. The latter, all of them founded at the beginning of the nineteenth century, are, as a rule, one or two in each province.

The Academy of Agriculture organized in 1874 a trial on a large scale of threshing machines and mowers on the occasion of an agricultural congress, but as a rule the machines which competed for prizes in the Swedish General Agricultural Congresses ("Allmänna Svenska Landtbruksmöten") were not submitted to trials. The agricultural congresses, which in the whole country, are held every five years in different parts of the country, at those of 1886, 1891 and 1896 certain groups of machines were tried by means of funds which on each occasion were appropriated by the State for this object.

In proportion as the demand for machines grew and the offer of the domestic and foreign manufacturers grew still more, it became necessary that in the choice of a machine, the agricultural public should have a more reliable guide than the prize judgment based only upon ocular inspection; hence the need of submitting to an exhaustive test the working of every machine exhibited at the Swedish general agricultural shows; for this purpose the establishment of permanent trial stations, working uninterruptedly, became necessary. The manufacturers themselves demanded the institution of trial stations with the expectation of obtaining useful information for the

struction. As a matter of fact it was in consequence of a donation of 500 crowns (£ 5 500) made by one of our largest agricultural machine constructors (The Separator Joint Stock Company) that these institutions started. According to the deed of donation there was to have been a station in each of the agricultural institutes of the country: at Ultuna in central Sweden, exclusively for agricultural machines, and at Alnarp in southern Sweden for agricultural and dairy machines; the trial of machines at these establishments was to be one of the conditions to be fulfilled before they could be exhibited and entered for the prize competitions at agricultural congresses; it was calculated that the capital given, with interest and the fees fixed for the entries to the trials, would have been sufficient for a little over ten years.

The regulations were drawn up in 1897 and when, almost at the time it had been foreseen, the fund was exhausted, the State granted from year to year the necessary sums with which to continue the work. In 1912 the institutions were reorganized. New regulations were introduced at the beginning of 1913, under which the State subvention, which is appropriated annually, amounts to 21 000 crowns (£ 1155).

#### ORGANIZATION.

The Trial Stations have a common board of management which deals with the business of general interest, such as the tariff of fees for the trials, the object of the work to be done, the nomination of certain members of special committees, etc.; but each of the Stations has a special committee which carries out the trials. Originally the director of the Institute and the director of machine building were *ex officio* members of the committee, as was the manager of the Institute's farm or the professor of dairying (in part concerning dairy machines); besides the above, an engineer, a practical farmer or dairy manager are nominated members of the committee. With this system the Stations worked independently of each other, and there was a danger of different principles being followed in judging. Further, the drawing up of the reports being entrusted to persons whose time was taken up by their regular work, it happened sometimes that the trials as well as the reports concerning them would be delayed for a long time. In order to avoid these drawbacks, since the reorganization of 1912 one director has been nominated for the two Stations, a salary which enables him to devote all his time to the trials and to the drawing up of reports. The directors of the institutes do not belong any longer to the committees. An assistant to the director and a mechanic are permanently appointed.

#### METHOD OF WORKING ADOPTED BY THE TRIAL STATIONS.

The trials include: machines already on the market (in this case the results of the trial must be published, whatever the conclusion may be); and machines under experimentation but not yet offered for sale: in this case

the maker has the right to demand that the results of the trial should be published. The trials of this class are naturally not so frequent as those of the first, as when a maker has brought a machine to the point of being tried he is usually anxious to begin selling it.

The trials are the following :

a) *Trials in series*, comprising whole classes of machines : they are generally organized every year for one or two classes of machines by the board of the Trial Stations and are free of charge.

b) *Individual trials*, for which a fixed fee is paid, are made at the request of farmers, or the manufacturers or vendors of the machines.

c) *Trials undertaken on the initiative and at the expense of the Trial Committees* ; they refer to machines which it appears desirable to make known.

Owing to the great numbers of trials of classes a) and b), only a few of class c) have so far been made.

It is formally stipulated that the machines submitted to trial must not be built differently from or with more care than those of the same type already on the market, and the Committee has the right of selecting from the vendors' store the machine of the type that has been entered for trial.

The person who enters a machine is obliged to be present at the trial, or if unable to attend, he must provide someone to represent him. He must, if he thinks fit, make preliminary trials until the machine is declared ready to be submitted to the trial proper ; when a machine is entered by a person other than the maker or his delegate, or when the trial is made on the initiative of the Committee, the maker must, if possible, be informed of the date of the trial, and he has the option of being represented. Besides the parties interested, no one has the right to be present at the trial without the Committee's authorization.

According to the tariff at present in force, the entrance fee, when it is due, is based upon the price of the object tested ; it varies from 10 to 100 kroner (11s to £4 2s 6d) according as the price is below 50 kr. (£2 or between 750 and 1000 kr. (£41 5s and £55) ; if the price is above £55 the fee is increased by 5 per cent. of the amount above this sum.

The features chiefly considered at the trials and in judging the machines are : *construction, quality of material, make, durability, capacity for quality of work done, consumption of power, facility of handling*, as well as the *price* if it deserves notice from some point of view. The question of judging by points has been much discussed and this system has sometimes been followed ; but on the one hand it is impossible to determine the relative numbers of points for the various qualities, and on the other hand a high final number, by which a buyer without critical sense might be tempted to be guided, might be the result of qualities which certain respects are of no importance for some buyers, whilst the machines for some other quality might not suit them. Thus the verdicts on machines are given only in words on the points mentioned above and some others which might have some weight in forming an opinion on a machine, but which would not have any on the final number in the case in which points are given according to a fixed scheme.

In order to judge most of the characters mentioned above, the Trial Stations possess the necessary instruments and tools, especially for measuring the consumption of power; for testing the materials it is often necessary to apply to the material-testing workshop of the Technical College in Stockholm. For the calorific value of fuels, recourse is always had to the College.

In most cases the trials are conducted on the farms of the agricultural stations, where special constructions have been erected for the Trial Stations and where it is possible, on payment, to have the necessary tractors, teams and power. When necessary the trials are made in other places and not at the Institutes of Alnarp and Ultuna. The makers of large motors avail themselves more than others of this concession, and use for them the trial in their own works, notwithstanding the travelling and other expenses and a higher fee paid to the members of the Committee, is cheaper than sending the machines to the Trial Station. For many machines, further trials, called the long trials, are held after the principal trials in the presence of the Committee are finished. The object is to demonstrate better the durability and facility of handling in ordinary farming; after these trials, the machines are examined by the manager and the farm hands report their experience of the use of the machine.

#### PUBLICATION OF THE RESULTS OF THE TRIALS.

Detailed reports of all the trials are drawn up; they include: the description of the object tried, the *account of the trial*, and the *judgment*. For several machines of the same class are tried at the same time, as in the trials by series, parallel comparisons, as far as possible in the form of series, are made of the special characters of the machines and the results of the trials. In cases in which the reports are not to be published, they are only communicated to the person who has had the trial made, the description is limited to what is strictly necessary to characterize clearly the machine or implement, so that if the trial is repeated it should be possible to see in what respects its construction has been modified. In the series trials these reports may be completed by a chapter on the group of machines examined, and also by special detailed tables with the results of the comparative trials used as a basis for the judgment, etc. It is always sought to give the final verdict in a concise form and to put it up in such a way that the maker can insert it in his prospectus or advertisements. When the Trial Stations learn that a judgment has been published with suppressions, or in such a way as to be misleading, they are bound to have the error publicly rectified.

The reports which are to be published appear in the Bulletin of the Station of the Trial Stations (*Meddelande från Styrelsen för Maskin och Kraftpröfningsanstaltarna*). The first of these Bulletins, reporting the trials made in 1898, appeared in 1899; up to September 1913, thirty-six Bulletins have been issued, in which a total of 3352 pages represent the



reports of the trials. Some of the earlier Bulletins were rapidly taken up and are out of print, but reprinting *in extenso* reports on machines some of which are out of date did not seem necessary, and in 1910 a summary of the first ten Bulletins was given in a volume of 300 pages.

#### CONCLUSION.

It is beyond discussion that the work of the Trial Stations has been of far-reaching importance for Swedish agriculture and for the Swedish machine industry. The extension of the movement bears ample testimony to its value. The power of the Trial Stations lies in the minuteness of the organization and in the conscientiousness with which the trials are conducted. If the new organization allows the results of the trials to be more promptly known, a desire frequently expressed by machine builders and vendors may be realized.

A proof of the great importance attached by all to the trials is that when an agent of a manufactory offers an agricultural machine to a merchant, the first question that the latter usually asks is "What is the opinion of the Trial Station"? And if the machine has never been presented to the Stations, the negotiations are generally broken off with the word "Come again when the machine has been tried". It has often been noted that the largest American firms have taken into consideration the verdict of the Swedish trials and have introduced into certain machines the modifications suggested by the trials.

### Present State of the Dairying Industry in Canada.

by

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According to the census of 1911, there were 2 594 179 cows in Canada that year. This was an increase of 185 502 as compared with the census of 1901. The increase was all in the Western Provinces. In all of the Provinces east of the Great Lakes there was a small decrease in the number of cows during the decade. The number of the cows, however, is only one of the factors which affect the production of milk, for we find that while the value of the total product in 1900 was \$66 470 953 it had risen to \$109 340 000 in 1910. In other words the increase in the number of cows during the decade was only 7 per cent., while the increase in the value of the total product was 60 per cent. In Ontario, where there was a decrease of 3 per cent. in the number of cows, the value of the product increased by 18 per cent. during the same period; in the Province of Quebec, with a decrease of nearly 2 per cent. in the number of cows, the value of the product increased nearly 35 per cent.

In 1900 the value of the total product was \$ 27 per cow and in 1910 \$ 42 per cow. Part of this increase in value must be attributed to the higher price in the latter year and to the fact that a larger portion of the total product was sold as market milk, but even after allowances are made, the figures show a very substantial gain in milk production.

The increase in the yield per cow resulting from better management of herds is mostly clear profit, and it is only fair to add that much of the credit for this result is due to the cow-testing propaganda carried on for at least 8 or 10 years by the Dairy Division of the Dominion Department of Agriculture. The farmers are encouraged to test and weigh the milk of the individual cows in their herds in order that the unprofitable may be eliminated and the herd built up by rearing the progeny of those that have the best records. This work has only just begun and it is a presumption that by the time the next census is taken a still greater increase will be shown.

Figures for the total value of dairy production in 1913 are not available, but we take the figures already quoted from the census of 1911, which give the value of total products in 1910, and allow the same rate of increase as there was between 1900 and 1910, the value for 1913 is approximately \$1,000,000.

The value of the different products in 1910 (Fifth Census) was as follows:

Factory Cheese . . . . .	\$ 21 587 124
Home-made Cheese . . . . .	153 036
Creamery Butter . . . . .	15 645 845
Home-made Butter . . . . .	39 889 953
Condensed Milk. . . . .	1 813 971
Milk and Cream consumed as such, or used for Ice Cream	30 250 005

Total \$ 109 339 934

#### CANADIAN CHEESE.

The cheese manufactured in Canada is almost entirely of the one resembling more nearly the English Cheddar than any other variety. Canadian cheesemakers adopted this type of cheese as being the one suited for the factory system, and because the taste in England, where cheese was looked for a market, was demanding cheese of that character. Canada, like most other countries, developed a special type of cheese of importance. A few families on the Island of Orleans make a limited quantity of a small, soft, highly fermented cheese, which is sold in Quebec. The process of its manufacture is either a modification or a skillful imitation of the method employed in making some of the French varieties, and was first practised in Canada by French colonists in the 17th century. A few foreign varieties have been introduced, like the Port-du-Salut (French) made at the Trappist Monastery on

the Ottawa River and sold as "Oka" cheese. There are several brands of "potted" cheese on the market, but these are prepared from ordinary Canadian Cheddar.

#### CONDENSED MILK AND MILK POWDER.

The manufacture of condensed milk and milk powders is becoming an important branch of the dairy industry in Canada. There are 12 large factories engaged in preparing these products, and the number is likely to increase. A total of 69 264 090 pounds of fresh milk was used for this purpose in 1910, out of which there was manufactured 27 831 596 pounds of finished products. The quantities are much larger at present, but exact figures are not available. The principal seat of this industry is Western Ontario, and the milk thus diverted from the cheese factories together with the milk and cream sent to city creameries, is rapidly diminishing the output of cheese in that district. The condensed milk is nearly all disposed of in the Western Provinces.

#### THE ICE CREAM TRADE.

The quantity of ice cream consumed in Canada has increased enormously during the past five or six years, and its manufacture is an important and growing factor in the disposal of the milk supply of the country. Statistics gathered from ice cream manufacturers in only 24 towns and cities in 1904 showed that they used the equivalent of over 2 000 000 pounds of butter for this purpose. Instead of being looked upon as a luxury or a confection, ice cream is coming to be considered as a food.

#### THE EXPORT TRADE.

Small quantities of butter and cheese have been exported from Canada for over one hundred years, but it was not until about the middle of the nineteenth century that a regular trade of any importance was established. The maximum export of 34 128 944 pounds of butter was reached in 1903 and the largest export of cheese, namely 233 980 716 pounds, was in the year 1904. After 1907 the quantity of butter exported declined rapidly, until in the fiscal year ended March 31st, 1913, less than one million pounds were exported to all countries, and for the first time in over twenty years practically no butter was shipped to Great Britain, the actual quantity being only 681 pounds. The exports of cheese for the fiscal year ended March 31st last were 155 216 392 pounds. In the year 1900, 37 per cent. of the total dairy production was exported, while in 1910 the exports were only 21 per cent. of the total production. The decline in the export of dairy products in the face of the increase in the production of milk is probably the result of a larger per capita home consumption, owing to the prosperous condition of the people and the improved quality of milk, butter and cheese offered for sale, but it is chiefly due to the large growth in population during the past 10 years.

*Comparative Value of Detailed Exports.*  
for Years ended March 31, 1909 to 1913.

	1913	1912	1911	1910	1909
	\$	\$	\$	\$	\$
.....	20 697 144	20 888 818	20 739 507	21 607 692	20 384 666
.....	223 378	2 077 916	744 288	1 010 272	1 521 436
and Milk .....	25 554	305 678	469 406		
Milk .....	1 412	975	4 276	541 372	90 520
.....	751 123	792 687	1 714 328		
.....	15 342	38 302	37 009		
	21 714 153	24 104 376	23 709 014	23 159 336	21 996 622

THE FACTORY SYSTEM.

Although there were over one million cows in British North America in 1861, the outlook for dairying at that time was not encouraging. It was impossible under the conditions which then existed. Cows were kept in most cases as a sort of side line and very few farmers specialized in dairying. The production of milk for cheese or buttermaking was limited to the amount of time which the farmer's wife and daughters could devote for that purpose from their other and oftentimes arduous duties, and the supply of dairy products so far exceeded the local demand that prices were unremunerative.

The introduction of the factory system of manufacturing cheese and butter saved the situation by making an export trade possible and opening the way for an increased production of milk with greater profit to the farmer. The first cheese factory in Canada was established in the province of Ontario, in 1864. During the following year, a cheese factory was opened in Quebec. The number of factories increased rapidly in Ontario until the year 1900, when the suitable territory was fairly well occupied. In Quebec there was not so much progress until after about 1883.

The first creamery in Canada was established in the Province of Quebec in 1873. The organization of other creameries immediately followed in both Ontario and Quebec and later in the other provinces, but there is still a large quantity of butter produced on farms in some districts. There is practically no cheese made on farms in Canada.

The comparatively sparse settlement and small number of cows kept on a reasonable radius of any given point have so far made it impossible to produce sufficient milk to put the cheese factory on a self-sustaining basis. In the territory west of the Great Lakes, except in some parts of Manitoba, the result has been that the cream-gathering creamery, whose operations

may be extended to a very wide territory, has been adopted as the most suitable form of the factory system for that part of the country. In the factory system the farmers who support the establishment provide themselves with hand-power cream separators, and send the cream only to the factory. The cream is delivered over long distances every second or third day, and thus a large saving is effected over the cost of delivering milk every day. In the milk system the milk must be delivered early in the morning the area from which it is obtained is necessarily much smaller than in the other system.

#### CHEESE FACTORIES AND CREAMERIES IN CANADA.

The latest returns show that there are 3760 cheese factories and creameries in Canada, and 112 condensed milk or milk powder plants. The cheese factories and creameries are distributed by provinces as follows:

Province	Cheese factories	Creameries	Combined factories	Skimmed milk
Ontario . . . . .	1019	128	59	1
Quebec . . . . .	894	576	698	113
Alberta . . . . .	3	53	1	—
B. Columbia . . . . .	—	23	—	—
Manitoba . . . . .	18	30	1	3
N. Brunswick . . . . .	24	17	3	—
Nova Scotia . . . . .	7	13	1	—
P. E. Island . . . . .	17	8	19	—
Saskatchewan . . . . .	2	17	—	—
	1984	865	782	127

The cheese factories and creameries are not organized on any one form plan. Many of them are owned and operated by individuals or in other are owned by joint stock companies, the shareholders of which may or may not be milk suppliers.

In the business organization of the factories, either proprietary or joint stock, the milk suppliers are the recognized owners of the plant and they usually appoint a salesman, a treasurer and other officers to look after their interests. In some cases the owner of the factory is appointed salesman.

The owner or company receives a fixed rate for manufacturing, except in very limited districts where the factories are operated on a percent of the value of the product sold. Where the fixed rate is in vogue it varies for manufacturing cheese from 1 to 1 1/2 cents per pound, and for butter 2 1/2 to 3 1/2 cents per pound for butter, according to the locality or competition between factories for a milk supply.

## ent Work and Progress in the Dairying Industry in Denmark

by

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Thirty years have now elapsed since the economic conditions in Denmark had got to such an extent that the exportation of cereals, which until had been of considerable importance, fell below the importation of flax and of feeding stuffs for live stock.

The value of the excess of imports of cereals and foodstuffs over exports constantly increased during the last thirty years, while the exportation of dairy produce has grown considerably during the same time. The shift from the sale of cereals to the present great sale of butter is especially due to the cooperative dairies. While formerly in each of the large small cows-keeping farms, about 180 000 in number, butter used to be made, at the present time the whole Danish production of butter is produced in about 1500 dairies, of which 1200 are cooperative, most of which are much larger than the 300 private ones (partly dairies that collect the milk from the producers and partly farm dairies).

In 1882 the first cooperative dairy was founded in West Jutland. A few years previously the cream separator had become a practical machine and was used in some dairies that collected and bought the milk from neighbouring farmers. These collecting dairies, however, as a rule were not successful; they could not pay suitable prices for the milk and did not have enough milk to work up, besides which their produce was often of inferior quality. The cooperative dairies were the first to attain satisfactory results, and they spread in the following years all over the country. Especially between 1887 and 1889 a great number of them were founded, and by 1893 it may be said that the whole country was provided with

Each of these cooperative dairies was founded by a group of farmers, who formed a cooperative association, drew up their statutes, elected a managing board, bought building land, bored or otherwise sought for water, built a dairy and a dwelling-house for the staff, bought the necessary machinery and plant and appointed a dairymen who in his turn employed the necessary assistants.

Every morning the milk is brought to the dairy in hired carts, so that the carriage of the milk is as easy for the producers living at a distance as for those quite close to the dairy. In the dairy the milk supplied by each producer is weighed and twice a week its fat content is determined, because the price is paid according to its value for butter making. After being weighed the milk is passed through a filter, warmed to 50 to 56° C. (122 to 131° F.) and then lugged. The cream is immediately pasteurized at 80 to 85° C.

(176 to 185° F.), then cooled and the starter added to it so as to be ready for churning the next morning. Only a part of the skimmed milk is used for making cheese; most of it, on issuing from the separator, is pasteurized at 90 to 95° C. (194 to 203° F.) and then weighed out still warm to the members, to whom it is sent, together with their share of buttermilk by the milk cart, thus all the members get back their skimmed milk, buttermilk, which they can use in their farms for feeding calves, pigs, foals or chickens.

The cooperative dairies were principally founded with the object of attaining the complete utilization of the butter-fat contained in the milk of the many small farms, while the manufacture of cheese was but little contemplated. Here and there the new dairies were built and equipped for the making of skim-milk cheeses, but as a rule the greater part of the centrifuged milk, as well as the butter milk, was sent back to the members, and only very few cooperative dairies were induced to take part in the beginning and on a large scale the retail sale of milk.

The production of butter was almost everywhere carried out successfully. Not only was it possible with the aid of separators to extract more butter from the milk, but as a rule the quality of the butter was better than that hitherto obtained by the numerous small producers and was consequently sold at very advantageous prices.

The result was that the cooperative dairies enabled the numerous small farmers to produce butter with the profit which up to then had only been possible for large farms; and even poor cottagers who possessed one cow find it profitable to contribute to the increase of the production of milk.

From the table given below, it will be seen how the butter trade developed in Denmark. The imports include butter from the south of Sweden and from Finland, Russia and Siberia, which is partly consumed in Copenhagen and partly re-exported by Danish steamers. This importation increased up to the begin of this century and is still fairly important while the exportation increased much more and has continued to grow.

In spite of the remarkable increase of the population of the towns and the greater purchasing power of the labouring classes, the excess of exports over the imports of butter has increased to a surprising degree. In this connection it must be borne in mind that Denmark consumes every year large quantities of margarine (91.08 millions of pounds in 1912).

The great increase in the production of butter is partly due to an increase in the number of cows (from about 900 000 in 1881 to 1 282 000 in 1914) but principally to better feeding and better selection and breeding of milch-cows. Since 1887 in the whole country about 1000 cattle-breeding associations have been founded, which promote the systematic breeding, keeping and development of the cattle of their districts by the following means: purchase and use of one or more special bulls for those cows of the members, which are considered suitable for breeding purposes, instruction in the management and judging of breeding, by taking part

*Danish Imports and Exports of Butter in millions of pounds.*

Year	Imports	Exports	Excess of exports over imports	Including milk and cream
69 average . . . .	1.17	10.85	9.68	—
74 " . . .	4.03	22.79	18.77	—
79 " . . .	5.43	28.95	23.52	—
84 " . . .	7.61	32.05	24.44	—
89 " . . .	11.88	55.73	43.85	—
94 " . . .	27.81	107.23	79.42	—
99 " . . .	36.65	145.20	108.75	—
04 . . . . .	50.58	195.89	145.31	—
. . . . .	41.80	208.10	166.30	3.10
. . . . .	41.38	208.89	167.51	5.83
. . . . .	40.57	226.86	186.30	6.29
. . . . .	32.71	230.16	197.45	6.16
. . . . .	35.97	233.79	197.82	8.25
. . . . .	30.50	231.40	200.82	12.39
. . . . .	37.62	243.91	206.29	15.22
. . . . .	32.19	234.54	202.36	20.97

shows, by keeping herdbooks, etc. Since 1892 (1), upwards of 500 record associations have been founded with the object of demonstrating the profitableness of cattle breeding and of promoting the formation of cattle capable of yielding a milk richer in butter. The means employed are investigations into the feeding and into the quantity and content of the milk yielded by the individual cows of the member-herds.

As regards the quantities of fodder consumed, it must be noted that up to the year 1883 the exports of cereals were in excess of the imports. The sale of cereals was an important source of income for both large and small farmers, at present a majority of farmers feed all their crops to their

) The first milk-record account with data on the milk and butter yield and consumption of fodder of every individual cow during the year was published in the *Mælkeri-* 1894, pp. 37-40.



stock ; and though considerable quantities of cereals are still sold, the of bought foods, especially maize, wheat bran and oil cakes, greatly ex them, while at the same time the areas devoted to root crops for fe purposes are steadily increasing. In 1912 Denmark had an excess r portation of maize and other cereals valued at about £ 2 200 000, a bran, cakes and the like worth £ 4 190 000. At the same time live, and beef worth £ 3 113 000 and bacon and other meats to the, val £ 8 327 000 were exported (1); further, the better feeding of catk pigs produces now considerable masses of manure which serve to im the productiveness of the fields and diminish the evil effects of unfe able weather.

The increasing quantities of milk have had the result of renderi original buildings of most dairies too small for present require. In many places buildings had been run up as cheaply as possible fr of incurring the burthen of heavy interest on the capital of exp plant in case of a fall in the prices of butter. But as dairying ; profitable and the quantities of milk increased, the means were found where with to enlarge the buildings and to provide new and s machines and implements.

The constant endeavour is not only to keep the dairies in good con but also to equip them always better, so as to be in a position to p butter of a finer and more uniform quality ; in this respect the p appointed consulting experts, as well as two good dairy schools, ha dered most valuable services.

The Agricultural Laboratory of the Royal Veterinary and Agric College has also contributed much to the general progress. Further, m large and small exhibitions exert an effective control as regards the of the butter, and the so-called Farm-Statistics Bureau, which unde the elaboration of a number of yearly accounts kept according to a u system, has for many years been a useful guide in the economic manag of farms. At first it was chiefly the question of the erection of ice- and of procuring larger and better steam boilers and engines, and of down better floorings and water supply; later came the apparatus for p izing cream and for multiplying the acid bacteria, or the demand for separators; now, in recent years, refrigerators, eletric lighting and rooms are the items that cause much expenditure.

Instead of the former small cheap dairies, now, in many localities dairies with lofty well-ventilated workrooms are to be seen ; they a provided with steam power, refrigerating plant, electric lighting and an abundance of good separators and other appliances, that every d to four thousand gallons of milk are separated in about three hours.

Since 1904, several dairies, especially in the south of the country begun to export cream to Germany, whilst most of the butter is n formerly, exported to England. This is due to the fact that Ge

(1) The value of the excess of exports of butter, milk and cream amounted to £ 11 425 000.

its ever increasing quantities of dairy produce, and as butter pays a of 10 per cwt. while cream is duty free, the importation of cream a greater margin of profit, notwithstanding its greater weight. The s given in the table on page 169 show that the exportation of cream Denmark has of late years steadily grown.

t must also be mentioned that of late years the production of cheese een encouraged in many ways. There are not only several milking dairies which manufacture various kinds of cheese from whole but also many large cooperative dairies which make cheese partly from milk and partly from a mixture of whole and skimmed milk. For years attempts had been made to manufacture cheese from pasteurized by 1906 there were already 25 dairies that used pasteurized milk : manufacture of cheese. In many dairies during recent years new ood cheese stores with insulating walls and refrigerating plant have uilt in order to protect the cheeses against too much heat in summer. esent about 55 million pounds of cheese are made every year in untry.

he great demand for casein in the year 1910 led to the erection of 20 casein-drying establishments, to which a great number of dairies red fresh casein, so that in 1911 more than 3.3 million pounds of , worth 3  $\frac{1}{2}$  *d* a pound, were exported. In 1912 the fall in prices l the production rather suddenly.

astly, it must be mentioned that a few years ago a condensed milk y was built at Nakskov in Lolland; in 1912 it exported £ 82 500 worth densed milk.

## s of International Statistics of Agricultural Book-keeping

by

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### I. GENERALITIES.

r the examination of the economic conditions of farming the methods n book-keeping give the most complete and reliable results, much r to those obtained by means of enquiries by question sheets. Recog- this fact the collection of the results of agricultural book-keeping an commenced of late years in several States. But in order that the obtained from several farms should be comparable with each other, necessary that they should be collected and elaborated according to ne methods.

the results of individual central offices for book-keeping are to be ed with each other, similar conditions must prevail in all. The value e observations increases the more they can be compared with other

similar material; it is necessary therefore to give them a *uniform basis* both the scientific and the practical points of view. The sooner uniformity is introduced in this direction, the more easily will the final aim be reached, for as long as this work is in its initial stages it will be much easier to prevail upon the book-keeping offices to adopt uniform methods, and later any modification of methods would complicate matters and interfere with the comparison of later and earlier results.

The following chapters are an attempt to outline the plan to be followed for this unification, and they will discuss the following subjects:

1. Definitions.
2. Valuation.
3. Methods of book-keeping.
4. Closing of accounts.
5. Elaboration of results.

## II. — DEFINITIONS OF THE TERMS USED.

The first condition to be fulfilled for the success of the investigation consists in defining the terms employed, and especially the following: *Agriculture* (Landwirtschaft), *Classification of capitals* (Kapitaleinteilung), *Gross product or gross returns* (Rohertrag), *Expenses* (Aufwand), *Net product or net returns* (Reinertrag), *Income* (Einkommen), *Income from whole estate* (Vermögenrente), *Compensation of labour* (Arbeitsverdienst), *Returns from the farm* (Landgutsrente), *Ground rent* (Grundrente), and *Capitalization of value or value based on returns* (Ertragswert).

1. — *Agriculture*. The enquiries must bear on the farming. The agriculture includes not only the cultivation of the soil, but also the working up of the crude products, especially in the form of keeping live stock, and accessory industries, such as dairying, wine making, distilling, brew sugar making and so forth, also belong to agriculture, in so far as they work up the crude products of a given farm. On the other hand if large quantities of crude products are bought outside the farm so that the property is no longer bound to the property, it is better to detach the accessory industry from the agricultural part and to treat it as an agricultural or private undertaking.

The *excavation of peat, gravel* and the like belongs to agriculture in so far as it is carried on chiefly with the object of utilizing fully the labour kept for agricultural purposes. The same may be said of *woods*. Large forests, the utilization of which is but loosely connected with the farm, should be separated from the agricultural work, and this especially when the average gross returns of the wood form a considerable part, and even more than half of the total gross returns. In the same manner *game and fish* are to be considered. Pond fishery may always be classed as agriculture.

*Trade* in agricultural produce must also be separated completely from the property does not contribute its crude products or its teams and labour.

the latter case the same rules are to be observed as for the accessory enterprises.

*Credits and investment of capital* (Kapitalanlagen) and their returns, are connected with agriculture except in so far as they have originated in use of the farm or act as a reserve for it.

*The private family account or personal account* (Privatverbrauch) must be separated from the farming account. The farm must not pay interest on those portions of the estate which are used for the family account, which are not to be considered in calculating the net returns on the capital, except to the extent that the farm has received compensation for rent or other services enjoyed by the private household. The more completely the calculating of such rents can be avoided and these capitals kept apart from the agricultural book-keeping, the more accurate will this be.

2. — *The capitals.* All the parts of one's estate that are used in farming which concur in producing profits are called *assets* (Aktivkapitalien) of the farm. In describing the assets of a farm, the land and other things owned or farmed by the farmer must be included, in particular the value of the farmed property. If this is not possible, they are to be treated separately and their results kept separate from those of the property, the assets of which are well known. This is not only necessary because the unitary nature of the assets, is wanting, but also because the amortization, the depreciation and the like can not be completely brought into the accounts.

As opposed to the assets are to be considered the *debts or liabilities* (Passivkapitalien). They comprise all obligations which have arisen, whether from acquisition of the assets or from the working of the farm. Debts incurred by mortgages, the origin of which is no longer known, in so far as they affect portions of the agricultural assets, are treated at the beginning of the accounts as farming liabilities.

The most important division of the assets consists in setting apart what belongs to the farm. That the soil, with the water sources and rights connected with it, the improvements and the buildings, form part of the farm, there is no doubt. But when the trees, and still more the field inventory, that is, the value of the seeds and of the labour expended in sowing them, is considered, then the uncertainty begins. We recommend including in the farm account everything that is connected with the soil, including the vines and field inventory, and to designate this as *farm capital* (Landkapital). The purchaser of a farm can always under every civil code demand that these objects be considered as an integral part of the property and that they be expressly excluded in the contract. Only when the plants are separated from the soil does the question arise as to whether they belong juridically to the soil or not. Whether these capitals are to be designated as farm capital or as ground capital does not matter. What is important is that they include the same elements. We prefer the expression *farm capital* (Landgutskapital) because it is more comprehensive than the term *ground capital* and gives less occasion for confusion with bare capital.

This latter term should include all those parts of the assets which are not consumed by usage. They may, it is true, be destroyed (for instance land carried away by floods), but usually they are not liable to deterioration and they require no amortization. To this group belong the soil and the atmosphere over it, the springs and the rights pertaining to the soil. The capital represents the permanent and indestructible component of the capital and consequently differs from all other forms of capital.

That part of the assets which does not belong to the farm capital is grouped under the name of *farming capital* (Pächterkapital) and includes dead stock (Geräte und Maschinenkapital), live stock (Viehkapital), stores (Vorrätekapital), credits (Guthaben) and cash working reserves (bare triebreserven). These three last capitals form together the *circulating working capital* (umlaufendes Betriebskapital).

The two terms farm capital (Landgutskapital) and farming capital (Pächterkapital) are quite separate. How far each component of the farm belongs to the agricultural assets is shown by the definitions of agricultural capital and agriculture.

3. — *Gross returns* (Rohertrag). The results of agricultural work expressed in terms of quantity and value of the produced, improved or acquired products are called gross returns. This term means the final gross of the whole farm, or essentially the agricultural produce that has been sold or used by the household or by the accessory industries, and to which is added that produce which has gone to increase the original capital of the stores, and is thus included neither in the receipts nor in the produce supplied by the farm to the household and auxiliary industries.

However simple the calculation of gross returns may appear at first sight, it is attended by a series of difficulties. Of the receipts only those of farm produce sold are to be entered. Credits for the same are to be entered at the end of the year. Receipts for credits belonging to previous years are to be excluded.

As *farm produce* not only the crops but all returns of the farm in the sense of the above definition are to be considered, consequently also receipts from the accessory industries, rents for those parts of the farm that have been used by the farmer's family, etc.

The receipts from the sale of land, improvements, buildings, machines and implements do not belong to the gross returns.

Especially attention is required in the treatment of *purchased raw materials and animals*. The gross returns of live stock keeping would be incorrectly represented if the animals sold, their produce delivered to the farmer and his family, as well as the increase of the live stock, were entered without deducting the value of the animals bought, since these were not produced by the farm. The same may be said of those agricultural products which are not transformed in the farm but are only sold again. Similarly fruit that is bought for the manufacture of wine or cider, milk bought from the dairy, potatoes for the distillery and so forth must be deducted from the gross returns. On the other hand fodders and manures purchased

well as seeds, are not to be deducted from the gross returns, as they are entered among the expenses. All purchased wares which have been deducted from the gross produce are naturally not to be included in the expenses.

The comparison of gross returns will be improved by deducting from them the extraordinary expenses incurred for disposing of the produce, for instance, as the expenses for railway carriage of produce to be sold. Among the items of gross returns the supplies in kind to the employees and labourers are included. Their value increases the labour by the same amount. If both were to be left out, the net returns would be equally correct, but both working expenses and gross returns would be low in comparison with those farms in which wages are given in cash and not in kind.

If the stock of provisions produced by the farm has increased, the increase is entered as a component part of the gross returns. But how is the opposite case to be treated, that is when the stock of provisions has diminished? As a rule the decrease must be entered among the working expenses, that is to say not deducted from the gross returns. The case is to be considered like the purchase of provisions, especially fodder, manures and so on; we do not subtract these from the gross returns, even when they are sold. Only when they are provisions destined to be sold is it more correct to deduct them from the gross returns. Their original amount was not contained in the gross returns of the preceding year as inventory at the end of the year's operation; being then sold in the course of the next year these provisions appear among the receipts again as gross returns. If they were not deducted the gross returns would be too high.

A part of the gross returns may also have been employed as *installation capital* (Anlagekapital) in the farm itself, for instance, timber for buildings. The values of goods for such objects are to be reckoned as components of the gross returns, and those used for the live stock capital, for the trees and other things (in so far as they are installation capital) appear in the variations of stock in hand at the end of the year as compared with that at the beginning.

It is to be observed that for crops and animals only the *difference between amortisement and increase* is determined. To proceed with more precision, those individuals the values of which had increased and those the value of which had diminished should be treated separately and the increase of the former and the amortisation of the latter introduced into the accounts. The amortisation is to be included among the expenses. A more precise method is especially to be recommended for live stock farming, but it renders special control of the live stock necessary, which is not customary in simple book-keeping. Consequently in general this distinction is not practised. For the draught animals, especially the horses, a special account is required, so that their amortisation does not appear as an increase of the total live stock, but always among the working expenses.

*Increases in the value of the soil, buildings, improvements, machines implements not owing their origin to supplies from the farm are comprised in the gross returns. Consequently such increases of value due to purchases or to improvement of market conditions must not be included in the gross returns.*

These considerations show that the definition of gross returns given at the beginning is not enough for practical work, but that it must be completed by further explanations. The following summary contains all the factors to be considered for an exact definition of gross returns.

#### Gross returns.

A. — *Receipts in cash from farm produce, including the credits from the same source existing at the end of the year. (N. B. The credits existing at the beginning of a year of operation must be kept separate and do not enter into the account of receipts nor into that of credit at end of year).*

- a. — Receipts from plant products.
- b. — " " animal products.
- c. — " " accessory industries (dairying, etc.).
- d. — " " letting of agricultural assets.
- e. — " " interest of reserve agricultural capital.

B. — *Products of farm delivered to labourers paid in kind, to the household and to the family.*

- a. — Plant products.
- b. — Animal products.
- c. — Products of accessory industries (dairying, etc.).
- d. — Rents of farm assets used by the household or family.

C. — *Increase of the stock of farm products at the end of the year over that existing at the beginning of same year.*

D. — *Increase of the stock of animals, fruit trees, standing timber, and field inventory over that existing at the beginning of year.*

E. — *Supplies of farm products to the soil, improvement, building, and implement capital.*

From the above amounts the following are to be deducted in the account as they are contained in them:

- 1) *Expenses for purchase of live stock.*
- 2) " " " " plants.
- 3) " " " " crude material for the accessory industries (milk for the dairy, fruit, grapes, cider, must for wine making, etc. for distilling, etc.).

4) *Expenses for purchase of agricultural produce destined to be sold again, in so far as their value or the product of their sale is included in the gross returns.*

5) *Extraordinary expenses for sale of produce (railway carriage for transport and the like).*

N. B. Similarly to these expenses, the debts for heads A to E are included at the end of the year, as well as all supplies from the account

ries to the household. Here also the debts from previous years are excluded.

— *Working expenses.* These represent the use and the outlay of money required for the production of the gross produce, with the exception of the interest on capital. We designate the sum of working expenses less the interest on capital as *Cost of production* (Produktionskosten). The working expenses include the cash outlay and the corresponding amount at the end of the year for seeds, manures, feeding stuffs, wood and other stores which have been used or are devoted to obtaining the gross product, besides those delivered by the household and by the private account to the farm, and further the amortisations and the outlay on labour. In order to establish the working expenses, what has been said on the gross cost must be considered. Nothing that has already been excluded from the gross produce must be included here.

Only the outlay for working the farm is to be included in the working expenses. Consequently all outlay for the purchase of land, improvements, buildings, machines and implements, as well as investments of capital (Kapi-tal) current accounts, deposits in savings banks, purchase of shares and stocks, must be separated. As for the way of considering purchases of stock and plant capital, it has been sufficiently discussed under the heading of returns. The debts at the end of the year are included, while debts from previous years are to be deducted. Personal supplies and those from the household are to be treated like outlays or debts.

All those constituents of the installation capital which are not wholly included in the working expenses must be represented in these expenses by means of amortisation corresponding to their wear and tear. In order to state this, the principle must be maintained that their original value and their final value must be as equally as possible distributed over the period of years that the object is likely to last.

The heading *labour expenses* includes not only the wages in cash, but also those in kind, the board for farm servants in the household (particularly in household expenses) and the wages of the farmer and his family. In

the amount of this last item the same salaries and wages must be stated as would have to be paid to strangers, both for manual labour and for management. In large farms the upper limit for management is 1 per cent. of the assets.

Expenses for the *interest on debts* and their *repayment* do not belong to the working expenses. As for the rate of interest on the capital invested, it must be fixed independently of the working expenses. It is useful and interesting from several points of view to fix this rate. It may be done according to the interest on debts the interest of the net assets. But in comparisons it is better not to consider the debts, but to calculate the interest on the whole assets capital at a determined rate, namely that the farmer would get on his money if deposited in a bank. If greater precision is desired, each group of capitals should bear a different rate of



interest according to the uninsurable risk to which it is exposed. But it is not sufficient to adopt a uniform rate of interest for the total asset capital.

Opinions differ as to the way of dealing with *rates and taxes* (Steuer u. öffentlichen Auflagen). Anyhow they cannot be reckoned as working expenses except to the extent that they are laid upon the capital of the farm and upon the income derived from it. A joint stock company will never do for a moment that taxes belong to its business expenses.\* Also other enterprises managed by juridical persons consider taxes in this way. Why should it not be the same with enterprises managed by private persons? We recommend therefore that all taxes connected with agriculture be reckoned with the working expenses, and in principle all prestations in kind. But as in book-keeping by single entry they are not included in the gross returns they are omitted here, and the net returns are diminished by the amount. This question will be treated again when the net returns are discussed.

Summarizing then: Working expenses include the following factors:

1). *Outlay in cash for capital in stores* including debts at the end of the year. (N. B. The debts at the beginning of the year are to be left out and are not to be included either in the cash outlay or in the debts at the end of the year.)

2). *Outlay in cash for labour* for working the farm (farm hands, wagenman, etc.).

3). *Cash outlay* for taxes.

4). *Articles for working the farm* drawn from the stores-capital of the household and family.

5). *Outlay on labour*.

6). *Amortisation of installation capital*.

7). *Diminution of the stock of stores-capital* at the end of the year compared with stock at beginning of year. From this is to be deducted the increase of the items of the stores-capital not included in the gross products (artificial manures, cakes, sulphate of copper, etc.).

5. — The *net returns* (Reinertrag). Under this term is understood the difference: gross returns minus working expenses. This value represents the revenue from the whole of the assets (Aktivkapital).

It emerges from the above that it is not possible to give net returns a more concise definition or one answering better to the requirements of the practice of book-keeping. The most important thing is clearness and uniformity of principles in the calculation of gross returns and working expenses.

To what has already been said there is not much to add, but a few words on taxes and burthens are necessary.

The net returns calculated according to our method represent the returns that remain to the farmer after having paid taxes and burthens. It is not to calculate the value of the land based on its returns, or capital value (Ertragswert des Bodens). If, for instance, a co-heir takes his share under the form of capital calculated according to the value of the net

es too little, because he exchanges a capital calculated as free from against another one subject to them. But this difference is com- by the fact that the rate of capitalization is frequently so at the usual taxes on capital are already deducted. It must be noted hat farming is often burthened with considerable special taxes which lists do not know (obligatory labour, land tax without deduction of etc.). The higher these burthens, the lower the price that the farmer pays e land. Calculating the value of the returns without taking these ns into account would be misleading. So long as it is a question of d taxes, the lower rates of interest offer sufficient compensation; for l taxes the deduction is justified. But to obtain the net returns of the free from burthens, the taxes must be added to the net returns. st method is to designate this value as *tax-free net returns* (Steuerfreier trag).

. — *Yield of the estate* (Vermögensrente). We call yield of the that part of the net returns which represents the interest borne by estate; it is found by subtracting the interest on the debts from t returns.

. — *Income* (Einkommen). Income can be defined as the money that one may consume without diminishing his estate. It is thus by adding to one's consumption the increase of the estate, or by cting from the consumption the diminution of the estate. In this e, however, accessory income may be included: this must be eted in order to find the *agricultural income*. This is found when terests on debts are subtracted from the net returns, and the s and wages of the farmer and his family are added; or, what is the when the yield of the estate is added to the above salary and wages. ome can also be defined as the difference between gross returns orking expenses without the salary and wages of the farmer and his , but with the interest on debts.

. — *The compensation for labour* (Arbeitsverdienst). This term desig- that part of the agricultural income which is left to the farmer as nsation for his work after he has calculated the customary local st on the capital that he has put into the farm. The compensation our is thus found by subtracting from the agricultural income the at of the interest on the estate without debts (Reinvermögen).

. — *The components of the net returns* (Bestandteile des Reinertrages). a certain amount is deducted from the net returns for interest on the g capital, the returns of the farm itself (Landgutsrente) remain, and from this the interests on the capitals representing crops, buildings mpvements are deducted, the ground rent (Grundrente) remains.

The farm returns thus represent the interest on the capital invested in the farm, and the ground rent the interest on the capital invested in bare soil. The latter capital is distinguished by the fact that its sources, namely the soil and the air, are imperishable, and though it may be exhausted can never be permanently exhausted.

10. — *Value based on returns or capitalization value* (Ertragswert). The value of the farm based on returns can be calculated from the net returns. It means the amount of money which, in a perfectly safe investment at the usual local rate of interest, would yield the same sum as the returns from the farm. The sum which would yield the equivalent of the gross returns (Grundrente) is the value of the bare soil based on its returns (Ertragswert des Bodens). The rate of interest chosen is based upon the interest borne by the safest State loans or by first mortgages.

It must, however, be considered that in the net returns all the expenses for management, taxes and insurance have already been deducted, so that the rate of interest must be correspondingly lower.

The value based on returns may also be calculated by capitalizing the whole net returns and then subtracting from it the amount of the fixed capital and of the capitals in crops, buildings and improvements.

11. — *Difference of net returns* (Reinertragsdifferenz). If from the gross returns, the sum which would be necessary to represent the interest on the fixed estate (Aktivkapital) at the usual local rate be deducted, the difference of the net returns remains. This value may be positive or negative as the case may be, and is of great importance, especially for the calculation of the cost of production.

### III. — VALUATION

The question of valuation is more important for agricultural book-keeping by double entry, in which the net returns are decomposed into their elements, than for the present enquiry. The major part of the net returns and of the working expenses, according to our definition, is composed of values for which the prices paid or received are stated. Any valuation must be made for the inventories at the commencement and at the end of the year. Nevertheless the enquiries of the Swiss Peasants' Secretariat have shown that on an average of the years 1908-11 the increase of inventory represent only 3.3 per cent. of the total gross returns, the diminutions of stores represent 2.5 per cent. of the total working expenses, while a further 5 per cent. of the expenses come from amortization. These figures show clearly how slight is the influence of the estimation of the value of these changes upon the final result. But the valuation of the installation capital is also important inasmuch as the estate value is used as a measure of the returns. According to the valuation of the farm the same net returns seem high or low.

Agricultural book-keeping can give no information on the true producing power of capital invested in agriculture, unless the price

ed of valuing the installation capital (Anlagekapital) at its cost (Gestehungskosten), that is, entering the sum that would have to be in order to obtain the object considered. The quotas of amortisement which former years of operation have been charged must be deducted. Those provisions or stores destined for the consumption of the household must be entered at the price that would be realized free from all taxes (Reinerlös), or at the probable price at which they could be sold after further worked up (Veredlungswert) (price minus sale costs and

we must restrict ourselves to these two fundamental principles, as we cannot engage here in the details of the theory of valuation. Besides, the essence of these two principles is sufficient to render the results of book-keeping comparable.

#### IV. — THE METHOD OF BOOK-KEEPING.

The number of manuals and methods of agricultural book-keeping is great. The attempt to give uniformity to all these systems is hopeless, as it would collide with the interests of many engaged in the publication of works.

Fortunately, in order to make comparable statistics of agricultural book-keeping it is not necessary to follow only one system of book-keeping. Whether the single entry, or the double entry, or the American, Italian or any system be followed is immaterial, provided one condition be fulfilled, namely that all intercourse of the farm with the outer world be completely controlled and separated. By the outer world, not only the market but the usual customers are meant, but also the head of the enterprise, his household and accessory industries. Everything that the farmer receives or supplies must be noted and entered as if he were a customer who buys or sold on credit.

Consequently the following books are indispensable :

1. An *inventory*, in which the capital is entered and its variations are recorded.

2. A *cash book* for registering the amounts of cash received or paid out.

3. A *housekeeping* or *farmer's book* for the registration of produce in and delivered to or received from the household, private consumption or accessory industries of the farmer.

In what manner the entries into these books are to be made and whether they are to be supplemented by other books, the book-keeper is left free to decide. The only thing to insist upon is that all the entries be arranged in a way that at the end of the year they may be distributed to the following accounts: *farm, common household, personal consumption and accessory industries*. In large estates where the family of the manager and the em-

A comparative representation of the various systems of book-keeping adopted in Germany will be found in my treatise: *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Landwirtschaft*. P. Parey, Berlin, 1911.

employees have separate households, that of the latter is connected with the farm and that of the former with the personal consumption account. The household account is then omitted. In peasant farm account is necessary in order to distribute the housekeeping expenses according to the number of days that the various hands were present. It is possible to close the accounts correctly for the farm alone without separating personal consumption from accessory industries; but to calculate the amount of total income and total consumption, the whole capital, whole cash turnover and all exchanges in kind must be divided between the four accounts: farm, household, consumption and accessory industries. This system also renders the auditing of the books by central book-keeping stations much easier. Detailed instruction of the way of keeping such an account is given in the writer's works (1).

## V — CLOSING OF ACCOUNTS.

The manner of closing the accounts depends partly on the system of book-keeping followed. As it is impossible to obtain uniformity in systems of book-keeping, it is evident that the way of closing accounts varies greatly. The legislation on taxes alone is enough to render uniformity in this respect impossible.

If it were enough to determine the net returns, the income and values deriving from them, the final results of the most different books could be collected, provided that in calculating these values, the principle of the above definition had been observed. This, however, would not be in every case, as the legislation on taxes frequently renders variations necessary. For this reason, and still more because international book-keeping statistics are valuable especially on account of the comparison between returns and expenses, we recommend a special closing of accounts for the object of an international enquiry, to be adopted besides the usual closing for local purposes. Every book-keeping institution keeps its usual way of closing accounts, but with the help of its books makes another balance sheet a basis for scientific investigation.

This second closing of accounts would consider its chief task to be in the resolution of gross returns and expenses into their elements. For this purpose the items of the inventory of the cash book and of the household book should be distributed in as many groups as there are divisions of gross returns on one hand and in the expenses on the other. Each division is an account with Dr. and Cr. which may be kept according to the German or Italian method, but not the American, because the number of ac-

(1) LAUR, *Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation der Landwirtschaft*.

LAUR, *Landwirtschaftliche Buchhaltung für bäuerliche Verhältnisse*. 5th Edit. Ann.

LAUR, *Comptabilité agricole de la petite et moyenne culture*. Published by the Société suisse des Paysans, 2nd Edit. Brugg, 1913.

age. Still simpler is the following system, which resembles the American, but in reality has nothing to do with it; it is rather German keeping in which a line is given to every account. The texts of the entries which are usually written under each other in the account are in the heading of the table. This leads to the double advantage having to write the text and of being able to condense the whole of the account in a few pages.

The system is described in my work: *Grundlagen und Methoden der Buchhaltung und Kalkulation in der Wirtschaft*, (Berlin 1911) at p. 55. Here an instance is shown in the tables at the end of this paper.

## VI. ELABORATION OF RESULTS.

In order to compare the results of book-keeping with each other, they must be reduced to a common measure. We describe below the method applicable to those values which it would be especially desirable to compare and to publish in a uniform manner.

*Net returns.* — This important value is given per hectare (2.47 acres) of cultivated area and in percentages of the capital.

*Agricultural income.* — As general measure only the extent is to be considered. For peasant conditions the number of days' work of the family, reduced to days' work of an adult, is a preferable measure.

*Returns of whole estate.* — This is compared to the net estate invested.

*Compensation of labour.* — This value is utilizable only for peasant farms. It is measured by the number of days' work of the farmer's

*Value of the farm based on returns.* — Besides the area, the gross return is especially suitable as a measure. The ratio between value based on returns and the gross return, or the factor of the capitalization value, is of great importance for the valuation on the basis of returns.

*Gross returns.* — It is not enough to calculate the total sum of gross returns per unit of area; the composition of the gross returns must also be considered as is shown by the example given. The individual sub-groups must be reduced per unit of area, but it is especially important to calculate the percentage composition of the gross returns.

*Working expenses.* — The same may be said for this item as for the gross returns. It should be expressed in its totality and in its constituent parts per hectare and according to percentages.

*Difference of net returns, or the farmer's profit.* — This value is compared with the gross returns. The figure shows by how much per cent. the prices obtained must be increased or lowered in order that the gross returns thus calculated should cover the whole of the expenses, including compensation for the farmer's family and the interest demanded by capital. The price modified by this factor thus represents the *cost of production*.

## Example :

Capital 100 000 frs. at 4 per cent. = 4 000 frs. interest  
 Net returns . . . . . 3 500 »

Difference of net returns, or farmer's  
 profit or loss. . . . . 500 »

Gross returns. . . . . 10 000 »

Difference of net returns in per-  
 centage of gross returns . . . . . 5 per cent.

Average price realized for milk . . . 20 centimes per l

Consequently cost of production :

$$20 + \frac{5 \times 0.20}{100} = 20 + 1 = 21 \text{ centimes.}$$

i) *Capital*. — The capital must be shown in its totality and according to its chief component parts (soil, improvements, buildings, forest trees, fruit trees, vines, field inventory or cultivation and : in fields, live stock, machines and implements, stores and cash) and to the unit of area and to percentages of the whole capital.

j) *Various values*. — Besides the above values a whole series of others be calculated ; thus for instance the household expenses for the day of an adult, the cost of the day's work per grown-up member of the family or per hired labourer, the value per hectare of the bare soil according to returns, etc. We refer the reader to the reports of the Swiss Peasants' Secretariat (1).

k) *Grouping of the relative data*. — It is desirable that the data also be divided according to the sizes of the farms, according to the systems of farming and according to the general trend of the farms. As for size we commend the following groups :

Farms	under 3	hectares (7.4 ac.)
"	between 3 and 5	(7.4-12.35 ac.)
"	" 5 "	10 (12.35-24.7 ac.)
"	" 10 "	15 (24.7-37 ac.)
"	" 15 "	30 (37-74 ac.)
"	" 30 "	70 (74-173 ac.)
"	" 70 "	200 (173-494 ac.)
"	" 200 "	500 (494-1235 ac.)
"	" 500 "	1000 (1235-2470 ac.)
"	above 1000	

As for the systems of farming, no general rules can be given, as conditions vary greatly. The following however may be given as examples :

(1) Untersuchungen betreffend die Rentabilität der schweizerischen Landwirtschaft. — Landwirtschaftliches Jahrbuch der Schweiz, 1913.







1. Grazing farms.
  2. Three-course rotation with fallow.
  3. Improved three-course rotation.
  4. Four-course rotation.
  5. Clover and grass leys with alternate cereal crops (Klee gras und wirtschafte n).
  6. Grass farms.
  7. Farms with limited live stock.
- for the general trend of the farm, the following may be mentioned :
1. Cattle breeding farms.
  2. Cattle fattening farms.
  3. Milk farms.
  4. Combined animal husbandry farms.
  5. Cereal farms.
  6. Mixed crops without sugar-beets or potatoes for distillation.
  7. Mixed crops with sugar-beets or potatoes for distillation.
  8. Sheep farms.
  9. Market garden farms.
- are also conditions vary to such an extent that only the main lines set down. For the distribution into groups, the chief character is position of the gross returns.

## VII. AIMS TO BE ATTAINED.

First it can only be the question of bringing more uniformity into scientific enquiries on book-keeping, by awakening interest in the and by teaching, and this is the object of the present paper. Then International Institute of Agriculture in Rome could collect all the statistics of agricultural book-keeping institutions and point out to the heads of such institutions the advantages of uniform notions and methods.

As a final goal, the systematic elaboration of all these results with a view to scientific and practical results should be contemplated. The International Institute in Rome might thus become the central book-keeping office of civilized peoples. Such an office would not only further the science of agriculture, but would also render the most valuable service in pointing out the measures to be adopted for practical farming, in the choice of produce for the market, in determining prices and in agricultural policy in general.

## SECOND PART. ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

DEVELOPMENT  
OF AGRICULTURE  
IN DIFFERENT  
COUNTRIES.

90 — **Agriculture in New Servia.** — ADAMOVIC, I. in *Oesterreichische Monatshefte den Orient*, Year XXXIX, No. 11, pp. 197-198. Vienna, November 1913.

The extension and importance of the cultivation of the chief crops of the territory recently acquired by Servia: vines, tobacco, melons, cereals, pulse, potatoes, beets, vegetables, hemp and flax; mulberry plantations for silkworm rearing, poppy growing for opium manufacture, sesame cultivation, chestnut plantations. The chief feature as regards live stock is the large number of buffaloes kept. Bee-keeping is widespread.

91 — **Agriculture in Uele (Belgian Congo).** — GOFFINET, J. in *Bulletin agricole Congo belge*, Vol. IV, No. 3, pp. 587-609 + 1 map and 27 figs. Brussels, September 1913.

The old district of Uele consists of the basin of the river bearing this name and of its numerous tributaries as well as that of the river Bomu and its tributary the Bili, and the basins of the Likati and Rubi rivers.

In its south-western part the agricultural district of Uele is decidedly equatorial while to the north-east its character is subtropical. The division between these two belts is marked by the rivers Bomokandi, Uele and Bili.

The swamps are relatively of small extent, so that mosquitoes are less numerous than in most of the rest of the colony.

The natives, who are considered the strongest of the colony, are numerous. They are peaceful and frequently well organized; they cultivate the land and are hunters or fishermen. Labour is abundant and easily recruited.

*Crops.* — Bananas, manioc, maize, sweet potatoes, ground nuts, mountain rice, and sugarcane are the most widely spread crops in the forest region (equatorial belt), whilst on the savannahs, wire grass, sorghum, sesame and haricots, with maize, manioc and sweet potatoes, are more cultivated.

The only system of fertilizing practised is by fallowing, which allows rest to the grasses of the bush to grow again and enrich the soil with their detritus.

With the exception of palm and sesame oils, which are objects of trade with peoples sometimes distant from each other, agricultural produce is consumed on the spot or not far off.

*Live stock breeding.* — Cattle is raised only in the eastern extremity of the Nile towards the summits which mark the watershed between the Congo and the Nile.

*Prices of domestic animals.*

Cattle . . . . .	8s to £2
Horses . . . . .	about £40
Asses . . . . .	£6 to 16
Mules . . . . .	£12 to 28
Sheep . . . . .	4s to £1
Powls . . . . .	up to 10d and 1s 8d.

The domestication of elephants gives very satisfactory results at Api.

**Recent Research on the Causes of Pellagra and New Views on its Cure.** — ALESSANDRINI, GIULIO. Sulla pellagra in Italia. Osservazioni epidemiologiche. — Reprinted from *Annali d'Igiene Sperimentale*, Vol. XX, New Series, Part IV, pp. 49, 1910. — 2. ID. and SCALA, A. Contributo nuovo alla etiologia e patogenesi della pellagra. (Reprinted from *Il Policlinico, Sezione pratica*, Year 1913) pp. 24, 1913. — 3. Pellagra triste.... Nuovi studi sulle cause e nuovi orientamenti per la cura. — *La nuova Agricoltura del Lazio*, Year I, No. 14, pp. 109-111. Rome, July 16, 1913.

RURAL  
HYGIENE.

*Pellagra in Italy.* — The Italian provinces infected by pellagra number 23; deaths due to this disease are estimated at 4000 per annum, while several hundreds of pellagrins are admitted every year to the asylums for insane. According to the official census, the number of persons suffering from pellagra was 33 869 in 1910, as against 104 067 in 1881. In Latium pellagra exists to a very limited extent: according to a subcommittee of the official committee for the study of pellagra, there were in the first half of 1913, 46 cases (including doubtful ones), distributed in 12 communes. But in Italy on the whole the disease is gradually decreasing, in Latium pellagra has always been stationary, both in the number of patients and in localities in which the disease appeared.

*Connection between pellagra and agriculture. Theories on the etiology of pellagra.* — According to the most generally accepted opinion, the disease is especially rife among rural populations, and some believe that it attacks man and other domestic animals.

Pellagra has been attributed in turn to the following specific causes:

1. The use of damaged maize as food (the maize theory of Lombroso and his school); on this has been based, in Italy, the prevention and cure of the disease and the legislation concerning it (Law of July 21, 1912, on the prevention and cure of pellagra).

2. A special infection caused by a germ (*Streptobacillus pellagra* which is believed to develop on spoiled maize (theory of Professor Gini Tizzoni).

3. Inoculations by special Diptera (sandflies), of the family Simuliidae allied to mosquitoes and living in running waters (Dr. Sambon's theory).

4. *Drinking the water of certain localities* (Alessandrini and Scala Theory). This theory has been corroborated by experiments carried out by Professors Alessandrini and Scala at the Institute of Hygiene at the University of Rome, under the auspices of Prof. Celli, Director of the Institute.

*The Alessandrini-Scala theory.* — The researches conducted by Alessandrini since 1909 lead to the conclusion that pellagra is a *sharply local* disease and that it is contracted in those determined districts in which the water usually drunk springs from clay soils or flows and stagnates upon the surface. He supposed at first that the specific cause was some parasite living in the waters and belonging to the Filaria group. But the first experiments made according to this hypothesis, caused it to be rejected, but at the same time confirmed that the disease was due to the water. Prof. Scala then supposed the pathological agent contained in the water to be of mineral origin and numerous experiments carried out on rabbits, guinea-pigs, dogs and monkeys confirmed the writers in their opinion that pellagra is the effect of a chronic poisoning due to silica in colloidal solution in waters of certain composition.

"Clay, which is a silicate of alumina, is the original cause of the disease, as rainwater acting upon it causes a hydrolysis, from which both silicic acid and hydrate of alumina, according to the conditions under which hydrolysis takes place, may pass into the water in colloidal form. However, as there is incompatibility between colloidal silica and alumina and they precipitate each other, there remains in the water only the excess of silica over that quantity required to precipitate the alumina; part of the colloidal compound silica-alumina, which is not to be confused with silicate of alumina, deposits, while the rest remains in extremely fine colloidal suspension, causing that persistent opalescence frequently observed in the water drunk by pellagrins. On entering the human organism, the silica causes a retention of sodium chloride, which, in contact with the proteins of the tissues, gives rise to the formation of hydrochloric acid, and consequently to a true poisoning by a mineral acid."

Not all waters containing silica cause pellagra, because, as is well known, *colloidal silica* may be influenced by some neutral salts or mixtures of these present in the water, which may prevent, alter, or in some cases increase the injurious effects of silica. By means of numerous experiments, the writers found that the salts which act beneficially are the alkaline carbonates in general and especially that of lime, which exists or may exist in drinking water.

*New prevention and cure of pellagra.* — As pellagra is the consequence of an excess of mineral acid in the system, the cure can only consist in its neutralization by means of an alkaline solution. The writers used solutions

trisodium citrate on diseased persons and animals; this treatment quickly proved beneficial. Admitting that colloidal silica may readily be rendered harmless by carbonate of lime, the prevention of pellagra consists simply in having an excess of carbonate of lime, as small pebbles, always present in the waters causing the disease.

At the same time the necessity of continuing the campaign against the use of damaged maize and its products does not cease, because this food is always one of the chief predisposing causes.

The Roman committee on pellagra has resolved to experiment on a large scale the new method of prevention and cure in some of the most important centres of pellagra in Latium.

- **The Imperial Japanese Tohoku University at Sapporo (Island of Yesso).**—MÜLLER, MAX in *Deutsche Landwirtschaftliche Presse*, Year XXXX, No. 88, pp. 1047-1049; No. 89, pp. 1060-1062. Berlin, November 1 and 5; 1913.

The Agricultural College at Sapporo, which was founded in 1876, was declared on September 1, 1907, to be a branch of the Sendai University. It comprises four separate three-year courses for agriculture, agricultural chemistry, forestry and animal husbandry. Schools of fishery, civil engineering, practical agriculture and practical forestry are attached to the institution, as well as a so-called preparatory school, in which students are prepared by a three-years' course of studies for the University. It possesses two university farms, 185 and 272 acres in extent, of which one is devoted to the experiments and practical work of the students, and the other is a model farm. Besides the above, the institution has also a botanical garden about 27 acres in extent and can avail itself of 127 244 acres of forest.

In the University itself there are 23 professors and 25 assistant professors, and in the schools attached to it about 50 lecturers. The total number of students last year was 898, viz. 211 at the University, 297 at the preparatory school and 390 at the other schools. As university students only young men possessing the leaving certificate of the preparatory schools are admitted. For admittance to the preparatory and other schools the leaving certificate of a five-years' medium school is required.

The writer describes the situation of the various school buildings, and discusses the three-years' curriculum of the preparatory and of the practical-agricultural school, the six to eight-years' curriculum of the elementary schools and the five-years' one of the medium schools. He concludes with some interesting data on Japanese student life.

- **The Rural Travelling Housekeeping Schools in Prussia in 1912.**—*Zeitschrift für das Ländliche Fortbildungswesen in Preussen*, Year 5, Part 2, pp. 47-61. Berlin, November 1913.

In 1912 there were in Prussia 250 rural travelling housekeeping schools in full working order, divided amongst 243 Districts ("Landkreise").

The numbers in the various provinces were as follows: East Prussia 11, West Prussia 3, Brandenburg 21, Pomerania 17, Posen 34, Silesia 37, Prussia 13, Schleswig-Holstein and the Hohenzollern territory 1 each, Hesse-Nassau 21, the Rhine Province 51.

EDUCATION  
AND EXPERIMENTATION  
IN AGRICULTURE  
AND FORESTRY

A total of 817 courses were held as against 564 in the previous year. The number of the eight-weeks' courses has risen from 407 to 681 and that of the longer from 67 to 103, while the courses of less than eight weeks' duration have fallen from 90 to 76. The 817 courses were attended by 13 581 girls and young women who had left school, an average of 213 per course. More than half of these (53 per cent.) came from the peasant classes, 20 per cent. were the daughters of country tradesmen, while 15 per cent. of the scholars belonged to the agricultural labourers' class and 12 per cent. to the professional and similar classes.

Of the 250 schools, 168 were supported by the District Communal Associations, 5 of them being under the management of Womens' Unions, 6 schools were entirely managed by Womens' Unions and 17 by private individuals and others. The whole maintenance cost amounted to £29 3s of which £11 0s 2d was contributed by scholars' fees and nearly half the remainder by the Districts.

#### 95 - Agricultural Shows.

##### *Belgium.*

1914. March. Brussels. — Exhibition of agriculture and agricultural machines and implements.

##### *Denmark.*

1914. March 30-31. Copenhagen, Grundtvigs Hus. — Seventeenth dairy show, organized by the Seeland-Laaland-Palster Agricultural Society and the Danish Dairy Society.

##### *France.*

1914. March. Carcassonne (Aude). — Competition for vine-mildew fungicides, arranged by "Société centrale d'agriculture de l'Aude". Offices: rue et hôtel Courtaire, Carcassonne.

March 15-30. Grasse (Alpes-Maritimes). — Agricultural, horticultural and industrial exhibition. Includes the following classes: 1) Perfumery; 2) Olive oil, and olive products, apparatus and accessories for preparation of olive oil; 3) Horticultural produce and materials; 4) Produce of other branches of agriculture and materials. May 20-27. Paris, Cours la Reine. — Spring horticultural show held by the "Société Nationale d'Horticulture de France".

May 21-24. Angers, Place de la Rochefoucault. — Second triennial show held by Maine-Anjou Cattle Breeders' Society. Sec: M. Delhommeau, Avenue du Château Gontier, Mayenne.

May 29-June 2. Lyons. — International Poultry Show, in connection with the U. Show. A Poultry Congress will also be held. Address: 3 Place des Cordeliers, 15.

##### *Germany.*

1914. June 9-Sept. 6. Minden (Westphalia). — Agricultural and horticultural show annexed to the Arts and Industries Exhibition.

##### *Russia.*

1915. St. Petersburg. — Great international exhibition of the cheese industry, including forms of utilization of milk.

##### *United Kingdom.*

1914. April 14-17. Dublin, Ball's Bridge. — Spring show of the Royal Dublin Society. Address: Agricultural Superintendent, Leinster House, Dublin.

Oct. 20-23. London, Royal Agricultural Hall. — Dairy show. Sec: F. E. Harries, 28 Russell Square, London, W. C.

Oct. 31-Nov. 6. London, Royal Agricultural Hall. — Brewers' show.

Nov. 28-30 — Dec. 1-3, Birmingham, Bingley Hall. — Cattle and Poultry Show.

Sec.: W. H. Lythall, Bingley Hall, Birmingham.

#### — Agricultural Congresses.

##### France.

May 22. Paris. — Horticultural Congress, organized by the "Société Nationale d'Horticulture", 84 rue de Grenelle, Paris.

### CROPS AND CULTIVATION.

**Temperature Coefficients in Plant Geography and Climatology.** — LIVINGSTON, B. E. and LIVINGSTON, G. J. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 349-375 + 3 figs. Chicago, November 1913.

This paper deals with the methods of interpreting climatic temperature as for phytogeographical purposes. Temperature and its influence on its growth vary only with respect to intensity and duration. As the controlling climatic conditions are only effective during the season of active growth, the duration factor is estimated as the time between the last killing frost of spring and the first frost of autumn. The temperature efficiencies for growth corresponding to the normal daily temperature means are deduced from the assumption that physiological processes conform to the Van't Hoff-Arrhenius principle and that the rate of growth has a temperature coefficient of 2 for each 10° C. of variation within the ordinary limits of environmental temperatures. Thus, if the rate of growth is unity at 50° F. and it doubles for each rise of 10° C. (or 18° F.) above this, and  $\mu$  represents the normal daily mean temperature (°F) then  $\mu_e$ , the corresponding temperature efficiency index, is given by the formula —

$$\mu_e = 2^{\frac{t-40}{18}}$$

The summations of the normal daily mean temperature and of the daily temperature efficiencies of various stations throughout the United States are indicated on charts. The positions of the isoclimatic lines thus obtained show a marked similarity. Therefore, for most of the area of the United States the two methods of estimating temperature effectiveness in plant growth give results which agree within the limits of 5 per cent. This similarity, however, is only superficial and roughly approximate, since the ratios of the two are not constant, but range in magnitude from 7.49 to 10.44.

The ratios between these two series of indices were indicated on another map and the positions of their isoclimatic lines suggest that these ratios are a measure of some as yet unknown climatic characteristic.

AGRICULTURE  
METEOROLOGY



— **Effect of the Nature and of the Water Content of Soils upon their Nitrogen Content** (Mitteilung aus der agrikultur chem. Versuchsstation in Halle a. S.).  
MÜNSTER, F. (author of Report) and ROSSON, W. P. in *Centralblatt für Bakteriologie*, II Abt., Vol. 39, Nos. 15-17, pp. 419-440. Jena, November 29, 1913.

The writers set themselves the following problems :

1. How do organic nitrogenous manures behave in different soils with various water content ?
2. How does sulphate of ammonia behave in similar conditions ?
3. Under what conditions and in how much time does the optimum formation of nitrates take place ?
4. At what degree of humidity do losses of nitrogen occur ?
5. What is the action of organic sources of carbon upon the nitrogen content when nitrate and sulphate of ammonia are added ?

With the object of answering the above questions, they conducted culture experiments in pots in the laboratory and with applications of nitrogenous manures at the rate of upwards of 2 tons per acre, that is quantities not practically applicable. The experiments were carried out on three kinds of soil containing the following quantities of nitrogen :

Soil	Nitrogen			
	nitric	soluble ammoniacal	total ammoniacal	total
	per cent.	per cent.	per cent.	per cent.
Sandy . . . . .	0.00103	—	0.00057	0.0016
Loamy . . . . .	0.00654	—	0.00119	0.1597
Clayey . . . . .	0.00152	—	0.00044	0.1723

The degrees of moisture experimented with were respectively 6, 12 and 18 per cent. for the sandy soil ; 8, 16 and 24 for the loam ; 8, 18 and 28 for the clay. The determinations were made after three, six and twelve weeks.

It appears that organic compounds of nitrogen decompose more intensely in sandy soils than in loams or clays when the degree of moisture is low ; if this increases the difference tends to diminish. On the contrary the transformation of sulphate of ammonia into nitrates takes place all the more rapidly the higher the water content in sandy soils as well as in loams and clays ; there is, however, a difference in the fact that in loam and clay the biochemical activity is greater, while with the lower degrees of moisture the transformations in sandy soils begin with more energy. It appears consequently that 6 per cent. of moisture in sandy soil is more favourable to bacterial activity than the 8 per cent. of clay soil.

The ammoniacal nitrogen which is formed from horn meal disappears rapidly in the presence of much moisture in the various soils ; on the contrary with a low degree of moisture it keeps longer, and the maximum is soon reached the lighter the soil. Thus in sandy soils after three weeks it was 36.66

cent., in loam after six weeks it was 41.28 per cent. and in clay after twelve weeks only 13.37 per cent. of the nitrogen that was applied. The absorption of ammoniacal salts is greater the heavier the soil. This must be especially noticeable in dry years. After 12 weeks the sandy soil can transform 97 per cent. of the sulphate of ammonia added to it, while loams and clays can transform up to 100 per cent., which however is not all found in the nitric form. With horn meal the formation of nitrates proceeded most favourably in sandy soils; only with medium water content did the other soils show similar conditions. The greatest quantities of nitrates produced in all soils by sulphate of ammonia, with the exception of sandy soil and, in the case of much moisture, during the first weeks.

In general the most intense formation of nitrates with the various manures occurs between the third and the sixth week after the manure has been given; only in the clay soil with the greatest moisture the maximum intensity of transformation appeared during the first three weeks. At the end of the greatest content of nitrate, that is after six weeks with medium moisture, the following were the proportions of easily assimilable nitrogen in percentages of the nitrogen applied:

Manure	Sandy soil		Loam		Clay soil	
	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.	nitric N.	ammoniacal N.
sulphate of ammonia	60.07	28.51	78.83	6.67	78.17	5.48
horn meal . . . . .	49.15	0.00	58.71	0.69	57.24	0.00

Thus, by giving mineral nitrogen fertilizers the plants have greater quantities of plant food at their disposal than when organic manures are given.

A considerable quantity of nitrogen was freed only with the highest water content, with sulphate of ammonia in loamy soil to the extent of 1.8 per cent. of the added ammoniacal nitrogen at the end of the experiment, and with horn meal 32.2 per cent. in loam and 32.7 per cent. in clay.

A very heavy addition of organic matter under the form of sugar reduced the soluble nitrogen compounds to such an extent as to cause a lack of nitrogen for the plants. Thus the ammoniacal nitrogen added to the free soils disappears more rapidly in the presence of sugar, but without a corresponding increase of nitrate, the nitrogen that disappears being taken up by the bacteria.

By the addition of sugar to the ammoniacal manure, with medium moisture and after six weeks, the content of nitric nitrogen diminished in the sandy soil from 57.52 to 50.87 per cent., in the loam from 58.10 to 52.97 per cent. and in the clay soil from 70.92 to 61.62 per cent. Consequently the nitrogen that was fixed and subsequently removed on the addition of sugar increased in the sandy soil from 18.18 to 26.18 per cent., in the loam from 32 to 43.20 and in the clay from 29.08 to 38.38 per cent.

The formation of proteids was also increased by the addition of organic matter, and the loss of free nitrogen in the sandy soil was 11.43 and in loam 14.67 per cent. of the nitrogen applied, while no loss was observed in the clay soil.

Lastly no fixation of free nitrogen could be proved.

99 — **The Displacement of Potash in Felspar by Certain Substances Employed as Fertilizers.**—*Comptes Rendus des Séances de l'Académie des Sciences*, Vol. No. 19, pp. 856-858. Paris, November 10, 1913.

The writer has resumed his investigations into the double decomposition which occurs when felspar rock is triturated in contact with solutions of certain substances. For this purpose a microcline of Utöe of the following composition was used:

silica . . . . .	66.03 per cent.
alumina . . . . .	19.12 " "
potash . . . . .	11.38 " "
soda . . . . .	2.96 " "
lime . . . . .	0.22 " "
ferric oxide . . . .	traces
magnesia . . . . .	"

This was ground and passed through a sieve with 70 holes to the square inch. Ten to twenty gms. were put into a mortar and subject to mechanical trituration for 130 hours in the presence of 100 cc. of water to which certain substances had been added. The liquid was then filtered through a collodion filter and analysed, with the results given in the accompanying table. It should be noted that besides the action of the added substances the felspar is subjected to the action of water and atmospheric carbon dioxide in every case:

Amount of felspar employed: gms.	Added substance	Potash dissolved		
		gms.	per cent. of the felspar	per cent. of the pot. in the mixt.
10	—	0.0112	0.112	0.96
10	—	0.0139	0.139	1.42
20	1 gm. sodium chloride	0.0741	0.37	3.25
15	" calcium carbonate	0.0407	0.27	2.38
15	" tricalcic phosphate	0.0336	0.22	1.96
15	" monocalcic "	0.0667	0.44	3.90
15	" sodium nitrate	0.0548	0.36	3.21
15	" ammonium sulphate	0.1260	0.84	7.38
15	" calcium "	0.0552	0.36	3.23

Clearly the added substances have in every case caused the displacement of a larger quantity of potash than was given up to the pure water.

Now substances dissolved in the soil water are derived from the action of water, more or less charged with carbon dioxide, on the rock parts of the soil itself, the ease with which the particles are attacked increases as their size diminishes. But this solvent power of water is further increased by the presence of other substances in solution, some of which, such as lime and gypsum, are normally present in soils, while others are added as fertilizers. Therefore the formation of the so-called "soil solutions" may be attributed to contact actions similar to the ones discussed above, where the intimacy of the contact was greatly accentuated owing to the experimental conditions.

With regard to individual results: soda, in the form of both nitrate and chloride, has a very distinct action and displaces an almost identical quantity of potash in both cases. It should be noted further that the less soluble salts, such as lime and tricalcic phosphate, whose solubility increases with the carbon dioxide tension of the soil atmosphere, displace very perceptible quantities of potash. Calcium sulphate and the very soluble monocalcic phosphate react more strongly, but the effect of the latter is limited by aggressive phenomena. Ammonium sulphate is the most active salt of all, as has already been noted by previous observers.

In conclusion, double decomposition plays an important part in the formation of nutritive soil solutions when the mineral elements in the soil and the added fertilizing material are reduced to a sufficiently fine condition them to react easily on one another.

- **Studies on Acid Soils of Porto Rico.** - LOEW, O. - *Porto Rico Agricultural Experiment Station, Bulletin* No. 13, pp. 23. Washington, October 1913.

An examination of certain clay soils in Porto Rico which owe their fertility to the nature of the clay rather than to the presence of organic substances. The soils were subjected to both chemical and bacteriological tests, the effect of lime was also investigated in some cases.

- **Bright Virginia Tobacco Soils.** - BLACKSHAW, G. N. in *The Rhodesia Agricultural Journal*, Vol. XI, No. 2, pp. 209-212. Salisbury, Rhodesia, December 1913.

A comparison of the mechanical analyses of typical tobacco soils from Virginia and North Carolina with those in Rhodesia, showing that the former are lighter in character, whether derived from granite or from limestone.

- **Sprinkling the Ground in Farming and Gardening.** - STRECKER, in *Deutsche Landwirtschaftliche Presse*, Year 49, No. 85, p. 1013. Berlin, October 22, 1913.

The writer describes some models of his sprinkling system. These were exhibited at the International Building Construction Exhibition at Leipzig in 1913 and are protected by patents. After dealing with their importance, the writer gives a description and illustrations of the different systems, which are simple, practical and inexpensive.

PERMANENT  
IMPROVEMENT  
DRAINAGE AND  
IRRIGATION

103 - The Influence of Manuring upon the Composition of Soils and Suitableness for Certain Crops. (Mitt. aus dem Institut für Boden- und Pflanzbaulehre der Kgl. landw. Akademie zu Bonn-Poppelsdorf). — MAUSBERG, A. in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 1, pp. 29-101. Berlin, 1913.

On the basis of the continuous manuring experiments commenced in 1895 in the experimental field of the Bonn-Poppelsdorf Agricultural Academy, the writer makes some remarks on the connection between manuring and the conditions and fertility of the soil. The observations refer to a five-year's rotation (1907-11) on a loam soil, physically well constituted, but but relatively poor in plant food; the manure given varied on the fourteen plots from a complete manure (nitrate of soda 2.4 cwt., kainit 6.4 cwt., double superphosphate, containing 40 per cent  $P_2O_5$  1.6 cwt., quicklime 7.8 cwt., calcinated magnesia 3.2 cwt. per acre per annum) to none at all. Thus the plots were: 1) unmanured, 2) with nitrate of soda, 3) with sulphate of ammonia, 4) with potash, 5) with phosphoric acid, 6) with lime, 7) with magnesia, 8) with complete manure, 9) do. without nitrogen, 10) do. with sulphate of ammonia, 11) do. with potash, 12) do. without phosphoric acid, 13) do. without lime, 14) do. with mixed manures, that is farmyard manure with phosphoric acid and potash. In some cases nitrogen was given under the form of dried blood.

The connection between the crops, the conditions of the soil and manures are summarized in Table I.

TABLE I.

Crop in rotation	Effect observed					Superiority of nitrogenous manure	Treatment which yields the maximum crop
	of nitrogen	of potash	of phosphoric acid	of the reaction of the soil	of the favourable structure of the soil		
Winter rye . . . .	slight	marked	slight	generally nil	uncertain	nitrate of soda, slight	complete or 2 manure
Oats . . . . .	strong	strong	marked	do.	generally nil.	nitrate of soda, marked	complete as above
Peas . . . . .	—	strong	slight	marked	do.	—	only with or potash or application of potash lime
Potatoes . . . . .	marked	very strong	slight	generally nil.	do.	sulphate of ammonia, marked, especially for quality	mixed manure
Sugar beets . . . .	strong	strong	slight	strong	strong	nitrate of soda, marked	complete or easily used nitrogen and sufficient potash high alkalinity favourable structure of soil

## CONCLUSIONS.

1. *Winter rye* proved very thrifty from every point of view; abundant manuring gives very low profits; loose soils are more favourable than compact ones; the soil reaction has no effect upon rye.

2. *Oats* require especially easily assimilable nitrogen (nitrate of soda); nitrogen, the development depends to a remarkable extent upon a sufficient supply of potash; there are no observations on the connection between yield and looseness and reaction of the soil.

3. *Peas*: good crops are obtained only by the contemporaneous use of ash and lime; deficiency of either causes the same diminution of crop as the want of both.

4. *Potatoes*: the character of typical potash plants is confirmed, as is the fertilizing elements potash acts with the greatest energy on the use of the crop, and as soon as it is lacking the yield falls off, even if the other elements be present in abundance. Sulphate of ammonia gives better than nitrate of soda. The reaction of the soil exerts no influence; consequently when the other elements are present, especially lime, the lack of lime does not cause any decrease of crop; the best crops have been obtained by 8 tons per acre of stable manure mixed with phosphatic and potash manures, notwithstanding an insufficient liming of the plot.

5. *Sugar beets* feel the want of any one or two of the following conditions:

- a) easily assimilable nitrogen,
- b) sufficient potash,
- c) increased alkalinity and favourable texture of the soil.

Beets differ from potatoes in many points: thus, though they require stable manures, they feel the lack of them less than do potatoes; beets react markedly to lack of lime, even when supplied with magnesia; whilst potatoes prefer sulphate of ammonia, beets prefer nitrate of soda; further, manures injure the starch content of potatoes more than sugar content of beets, and while the use of potash salts deteriorates the quality of potatoes, it improves that of beets; lastly, for both these crops phosphoric acid produces only an insignificant increase of yield, but sulphate of ammonia exerts a favourable influence on the formation of carbohydrates.

**Results obtained at the Tjikeumeuh Experiment Garden with various Green Manures.** — VAN HELTEN, W. M. in *Mededeelingen uit den Cultuurtuin*, No. 1, pages 1-9 plates. Buitenzorg, 1913.

The plants with which experiments were made at Tjikeumeuh (Buitenzorg) were divided into four groups according to the most suitable method of utilizing each kind.

I. — Green manure plants sown between the rows of the main crop and the leaves of which may be cut regularly.

Plant	Qualities	Defects
<i>Tephrosia candida</i> . . . . .	Lives long, leaves abundant, decomposition slow *	Very rapid decomposition.
<i>Chloria cajanifolia</i> . . . . .	do	
<i>Leucaena glauca</i> . . . . .	Lives very long, abundant production of seed, stands slight shade.	
<i>Tephrosia hookeriana</i> var. <i>amoena</i>	Adapts itself to poor soils.	Numerous fail to grow.
<i>Desmodium gyroides</i> . . . . .	Lives long.	
<i>Indigofera Anil</i> . . . . .	Lives long, leaves fairly abundant, large production of seed.	Rapid decomposition.

\* The slowness of decomposition allows a plant to be used as mulch.

II. — Green manure plants which may be worked in before planting the main crop, or which may be used as I, but yielding only one crop.

Plant	Qualities	Defects
<i>Phaseolus calcaratus</i> . . . . .	Covers the soil rapidly, leaves abundant.	Lives only one year.
<i>Pueraria phaseoloides</i> . . . . .	do	Attacked by beetles.
<i>Crotalaria incana</i> . . . . .	—	Attacked by several insects, come badly.
<i>striata</i> . . . . .	—	The stalk becomes woody.
<i>laburnifolia</i> . . . . .	Leaves abundant.	Destroyed by insects.
<i>quinquefolia</i> . . . . .	Rapid growth, gives in a short time a large quantity of leaves, does not become woody.	Destroyed by insects.
<i>alata</i> . . . . .	Cover the soil rapidly, do not become woody; <i>ferruginea</i> has a special abundance of leaves.	Destroyed by insects.
<i>ferruginea</i> . . . . .		
<i>juncosa</i> . . . . .	Rapid growth on good soil.	Must be sown, lives 6 months.
<i>Vigna sinensis</i> . . . . .	Grows rapidly, leaves abundant.	—
<i>Cassia mimosoides</i> . . . . .	Rapid growth, great quantity of seed.	Must be sown, lives 6 months.
<i>pauciflora</i> . . . . .	do	
<i>Conocaulis ensiformis</i> . . . . .	Adapts itself to very bad soils.	—

## III. — Climbing green manure plants which can be used as I.

Plants	Qualities	Defects
<i>ma Plummeri</i> . . . . .	Luxurious growth, throws out roots at every node, does not climb much, yields much seed, even on the ground; can live three years.	Climbs a little, so the main crops must be disengaged every six weeks.

## — Climbing green manure plants which can be used only by working them in before planting the main crop.

<i>as</i> sp. with violet flowers white seeds. . . . .	Luxurious growth.	Attacked by disease and dies in 9 months.
<i>lus lunatus</i> . . . . .	Lives 2 years.	

The writer gives the following data on *Tephrosia*:

	Yield of green leaves per acre	Quantity of seed required per acre
<i>ida</i> . . . . .	8 480 lbs.	112 lbs.
<i>riana</i> . . . . .	7 580 "	121 "
<i>iii</i> . . . . .	8 030 "	136 "

Comparative Manuring Experiments with Calcium Cyanamide, Nitrogen me, Nitrate of Soda and Sulphate of Ammonia on Sandy and Peaty ls. — TACKE, BR. and BRÜNE, FR. in *Die landwirtschaftlichen Versuchs-Stationen*, LXXXIII, Part I-II, pp. 1-100. Berlin, 1913. (1).

In order to throw further light on the results previously obtained by experimenters, some experiments on the use of calcium cyanamide (stickstoff) and nitrogen lime (Stickstoff-kalk) in comparison with : of soda and sulphate of ammonia, were conducted on sandy and soils by the Bremen Experiment Station for Moor Cultivation. The results for the years in which the nitrogenous manures had a fair d effect are given in Tables I and II.



TABLE I. — *Comparative effects of the various nitrogenous manures according to the crops.*

Crops		Relative yields: crop of grain and straw or tubers due to 1 of soda = 100.					
		Nitrate of soda	Sulphate of ammonia	Cyanamide or nitrogen lime; when s			
				3 to 4 weeks before sowing	2 weeks before sowing	1 week before sowing	with seed
I. Sandy soils.							
Rye: average . . .	grain . . .	100	73	—	—	—	—
	straw . . .	100	82	—	—	—	—
Oats: average . . .	grain . . .	100	71	114	62	95	44
	straw . . .	100	82	91	60	66	46
Potatoes: average, tubers . . .		100	—	100	75	88	107
Total average	grain or tubers . . .	100	72	107	69	92	76
				89			
	straw . . . . .	100	82	91	60	66	46
II. Peaty soils.				Cyanamide			Nitrogen
				3 weeks before sowing	with seed	as top-dressing	with seed
Rye: average . . .	grain . . .	100	92	—	—	66	—
	straw . . .	100	103	—	—	64	—
Oats: average . . .	grain . . .	100	85	69	67	82	33
	straw . . .	100	88	63	55	72	27
Potatoes: average, tubers . . .		100	—	56	52	83	—
Total average	grain or tubers . . .	100	89	62	60	77	33
				67			34
	straw . . . . .	100	96	63	55	68	27
				62			34

TABLE II. — Utilization by cereals of the nitrogen of the various fertilizers.

Crops.	Amount taken up by crops on 100 parts of nitrogen given			
	Nitrate of soda	Sulphate of ammonia	Cyanamide	Nitrogen lime
I. <i>Sandy soils</i>				
average . . . . .	51	29	30	30
" . . . . .	56	54	30	26
" . . . . .	54 (100)	42 (78)	30 (56)	28 (52)
			(54)	
II. <i>Peaty soils</i>				
average . . . . .	42	42	23	37
" . . . . .	55	55	32	37
" . . . . .	49 (100)	49 (100)	28 (57)	37 (76)
			(67)	

As for the relative action of cyanamide compared with nitrogen lime, results on sandy soils are given in Table III.

Year in which experiment was made	Dressing of nitrogen in manure lbs. per acre	Crops	Increase of crop over non-nitrogenous manure lbs. per acre			
			Cyanamide		Nitrogen lime	
			grain	straw	grain	straw
1908-09	40	Rye	854	1050	727	1022
1910	40	Oats	167	282	184	385
1910-11	40	Rye	621	834	539	811
Average . . .			547	722	484	740
Relative effect . .			100	100	88	92

## CONCLUSIONS.

The opinion of several experimenters that the effects of nitrogen lime red by the Polzenius process were the same as those of calcium cyanide prepared by Frank's process, seems to be confirmed as to sandy soils

by the present experiments. On peaty soils however it appears that is not the case, for the average effect of nitrogen lime was only 91 per cent. of that of calcium cyanamide; however within the individual experiment deviations in the results disappear more or less completely and nitrogen shows an even better utilization of nitrogen; nevertheless it is probable that the chloride of lime which enters into the preparation of nitrogen is not without effect on acid soils such as peats, and is liable under certain circumstances to be injurious.

II. In order to obtain the best possible results in sandy and peaty soils with cyanamide and nitrogen lime, it is necessary according to the experiments to pay attention to the following points:

a) Calcium cyanamide must never be spread together with the seed as it injures its germinative energy; oats appear the most sensitive to this action, especially in sandy soils, and in this case the effect of cyanamide was only 44 per cent. of that of nitrate of soda.

b) As a top-dressing, calcium cyanamide does not give the same results, especially with rye, on either sandy or peaty soils; in the case of a late top-dressing on rye, where the effect of nitrate of soda was taken as equal to 100, the effect of calcium cyanamide was 67 on sandy soil, 66 on peaty soil. On oats and potatoes the effect was better, being 89 per cent. on sandy soil and 82 per cent. on peaty soil of the effect of nitrate of soda, a little less than when it was applied some time before sowing.

c) The best results with cyanamide were always observed when it was given some time before sowing, especially in sandy soil, when it averaged 89 per cent. of nitrate of soda. On giving cyanamide eight days before sowing and harrowing it in immediately after spreading, no injurious action on the germinative energy of the seeds is noticed; this short time is to be enough for the processes of transformation which take place in contact with the moist soil to proceed sufficiently to cause the toxic character of the initial products of decomposition to disappear completely.

d) The utilization by plants of the nitrogen in cyanamide is inferior to that of the nitrogen in sulphate of ammonia and in nitrate of soda; thus the utilized nitrogen in the latter is 100, that in cyanamide averaged 67 in sandy soils, and 67 in peat soils.

III. Whilst it appears to be confirmed that cyanamide opportunistically and suitably used is an efficient manure for sandy and peaty soils, farmers must consider before using it extensively if this manure is offered at a high price, because, owing to the superiority of nitric nitrogen, this element in cyanamide must be quoted at a correspondingly lower price.

#### 106 - Nitrogenous Fertilizers Obtainable in the United States. (1) - TURRENTINE,

— *Bulletin of the U. S. Department of Agriculture*, No. 37, *Contribution from the Bureau of Soils*, Washington, December 8, 1913.

The following materials constitute the present sources of nitrogenous fertilizers in the United States:

(1) See INSTITUT INTERNATIONAL D'AGRICULTURE, *Production et consommation de engrais chimique dans le monde*.

Artificial nitrates (calcium and ammonium).  
Nitrate of soda.  
Sulphate of ammonia.  
Fish scrap or guano.  
Tankage or slaughter-house refuse.  
Dried blood.  
Cottonseed meal.

The home production in 1912 was as follows:

Sulphate of ammonia . . . . .	138 400 tons (155 000 short tons) (1)
Calcium cyanamide . . . . .	4 000 "
Tankage . . . . .	222 535 "
Dried blood . . . . .	79 794 "

2 000 tons of cyanamide were also produced at Niagara Falls, Ontario, Canada. The figures for tankage and dried blood are calculated from the total slaughter of stock in the country, but only the larger slaughter-houses utilize their waste products to best advantage.

To the production must be added the imports, as follows:

518 613 tons of nitrate of soda	(1911)
2 302 " "	lime "
60 000 " "	sulphate of ammonia (1912)

The consumption during the same period is given in the following table.

*Sources of Nitrogen used in Mixed Fertilizers in the United States.*

Material	Amount used	Nitrogen content	Nitrogen yielded by fertiliser
	tons	per cent.	tons
Sulphate of ammonia (2) . . . . .	198 400	19.75	—
Nitrate of soda . . . . .	70 000	15.5	10 850
lime . . . . .	—	12.75	—
Calcium cyanamide . . . . .	11 264	18.0	2 028
Cottonseed meal . . . . .	—	6.5	—
Lodging { Bu. of Animal Industry . .	161 950	6.5	10 527
	Lodge . . . . .		
scrap . . . . .	99 324		6 456
blood { Bu. of Animal Industry . .	70 000	9.0	6 300
	Lodge . . . . .	11.0	6 322
	37 710		4 148

(1) According to the American Coal Products Co., New York, the production in 1912 was 147 000 tons. (Ed.).

(2) According to the American Coal Products Co., New York, this figure should be 100 tons. (Ed.).

The figures for sulphate of ammonia may be too large, as they are the proportion of the substance which was employed otherwise than as fertilizer. Those for nitrate of soda were obtained by taking 13 per cent of the total imports, that being the amount which is attributed to fertilizers; and this estimate may be somewhat low, as 5 per cent. of the imports are unaccounted for and may also be used in the fertilizers industry. The sets of figures are given for tankage and dried blood. They are based on the respective estimates of slaughter in the United States made by the Bureau of Animal Industry and by Mr. F. S. Lodge. The Bureau of Animal Industry derived their estimate of the slaughter partly from the number of animals killed under government inspection, which they regard as 10 per cent. of the whole.

107 - **The Situation of Guano in Peru.** — 1. Annual Report of the Guano Company « *Compañía Administradora del Guano, Limitada* », in *Peru To-Day*, Vol. V, pp. 858-859. Lima, July 1913. — 2. BELLINGHURST. The President's Financial Message. — *Ibid.* No. 6, pp. 944-968. September 1913 (1).

In the financial message of the President of the Republic of Peru Congress the following information is found :

According to the contract of January 11, 1890, between the Peruvian Government and the "Peruvian Corporation Limited", the latter was granted, besides other concessions, the following :

a) — The guano existing in Peruvian territory up to the amount of three million English tons, which amount was subsequently reduced to 1,500,000 tons.

b) — The surplus over 50 per cent. of the guano on the Lobos Islands which belonged to Peru, after liquidating accounts with Chile.

In accordance with clause 21 of the contract of January 11, 1890, that Corporation has exported from the Peruvian deposits the following quantities of guano :

Years	Tons declared
1891 to 1895 . . . . .	166 877
1896 to 1900 . . . . .	122 739
1901 to 1905 . . . . .	350 169
1906 to 1910 . . . . .	382 151
1911 to 1913 (April) . . . . .	112 982
	<hr/> 1 134 918

The proceeds from the guano sold by the Peruvian Corporation from 1892 to June 30, 1912, were as follows :

Years	£
1892 to 1896 . . . . .	376 133
1897 to 1901 . . . . .	322 886
1902 to 1906 . . . . .	808 477
1907 to 1911 . . . . .	712 457
1912 . . . . .	141 143
	<hr/> £ 2 361 096

(1) See No. 112, B, Feb. 1913.

Peruvian agriculture has only been able to supply itself with guano the year 1896 to 1912, as follows:

Years	Tons
1896 to 1900 . . . . .	18 384
1901 to 1905 . . . . .	102 216
1906 to 1910 . . . . .	177 212
1911 to 1912 . . . . .	76 048
	<hr/> 373 860

The annual average for the quinquennial period 1906-10 is 35 442 tons, the average for the last two years has been 38 024 tons.

The supply for the present year will reach 40 000 tons.

The report of the "Compañía Administradora del Guano Limitada" its fourth year of operation, from April 1, 1912, to March 31, 1913, gives her particulars on the production and home consumption of guano in (See table on page 206).

The greater part of the high grade guano extracted during the past has been taken from the South Chincha Island, in conformity with rotation plan now in effect. Other deposits of minor importance have been worked in accordance with the Government distribution decree February 25, 1909.

The quantity of guano extracted by the Company for distribution in the Republic for the past four years in comparison with the demand is as follows:

Year	Demand Spanish tons	Production tons	Percentage of supply
1909-10 . . . . .	38 577	25 370	60
1910-11 . . . . .	58 901	24 921	39
1911-12 . . . . .	73 901	18 656	20
1912-13 . . . . .	105 771	24 350	20

The Directors state their belief that the increased demand is due principally to the desire of the various users of the fertilizer to secure a order by ordering more than they require. The directors of the Company propose to adopt measures which will result in a rectification of this irregularity.

The proportion of nitrogen in the high-grade guano excavated and the prices for the four years are given as follows:

Year	Percentage of nitrogen	Price per unit	
		s	d
1909-10 . . . . .	10.04	3	2
1910-11 . . . . .	10.70	2	5
1911-12 . . . . .	10.14	2	4
1912-13 . . . . .	9.18	3	0

Table showing deposits worked and detailed production of the Guano Company for the past four years (in Spanish tons).

Deposits	1909-10		1910-11		1911-12		1912-13		Totals	
	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor	Rich	Poor
Isla Sur de Chincha . . . . .	23 512	—	—	—	—	—	20 083	—	43 595	—
Grupo de Asia . . . . .	1 163	—	135	—	—	—	91	—	1 254	—
Palominos . . . . .	372	—	—	—	—	—	1 128	—	1 500	—
Fronton . . . . .	—	850	—	—	—	—	—	—	—	850
Isla Centro de Chincha . . . . .	—	—	—	—	—	—	—	—	—	—
Sombretinos . . . . .	—	—	20 811	—	—	—	—	—	20 811	—
Viejas (Bahia Independencia) . . . . .	—	—	648	642	1 320	—	361	—	2 359	642
Pachacamac . . . . .	—	—	—	8 655	—	1 950	—	12 242	—	22 847
Islas Norte de Chincha . . . . .	—	—	—	855	—	—	—	—	—	855
Punta Negra . . . . .	—	—	—	—	15 488	18 850	—	—	15 488	18 850
Obillos e Isla Blanca . . . . .	—	—	—	—	873	—	886	—	873	—
Isla Occida . . . . .	—	—	—	—	691	—	171	—	1 577	—
Santa Rosa . . . . .	—	—	—	—	284	—	455	—	1 354	—
Olleros . . . . .	—	—	—	—	—	—	276	—	1 354	—
Other small deposits . . . . .	323	—	3 327	—	—	—	—	—	3 650	—
	25 370	850	24 921	10 152	18 656	20 800	24 350	12 242	93 297	44 044

\* The Spanish ton used in Peru = 2028.56 lbs. English.

## Summary.

	Total	
	Rich	Poor
1909-10 . . . . .	25 370	850
1910-11 . . . . .	24 921	10 152
1911-12 . . . . .	18 656	20 800
1912-13 . . . . .	24 350	12 242
	93 297	44 044

The prices of low-grade guano containing less than 3 per cent. of nitrogen for the past two years have been as follows :

Year	£.	s.	d.
1911-12 . . . . .	1	9	3
1912-13 . . . . .	2	0	0

Lastly, in the above-mentioned financial message, the President of the Peruvian Republic states that from the year 1841, when the exportation of guano commenced, to the year 1879, Peru exported over 12 million tons of that fertilizer, with a net profit to the State of about £80 000 000. The expert ornithologist, Dr. H. O. Forbes, who had been invited by the Guano Company and by the Government to report upon measures adopted to prevent the disappearance of the guano-producing birds, presented his report to the Government at the end of April 1913.

**Sulphate of Copper: Production, Trade and Consumption.** — CRIVELLI, R. in *L'Industria Chimica*, Year XIII, No. 24, pp. 369-374 + 1 diagr. Turin, December 25, 1913.

Following on the diffusion of Millardet and Gayon's works (1885) on the influence of copper compounds on vine mildew, all the measures suggested for the control of the parasite were modified and only the active substances (sulphate of copper and lime) were retained. Nevertheless during several years the double sulphates of copper and iron, copper and zinc and also of copper and nickel were still used, and the chemical works, before starting fully the manufacture of sulphate of copper on a large scale, hesitated some time between the production of pure sulphate of copper and the soluble salts.

The sulphate of copper industry commenced in England between 1885 and 1890. In 1894, that country exported 786 metric tons (1), almost equally divided between Italy and France. The development of production in the whole world is shown by Table I (pp. 208-209).

As for the consumption of sulphate of copper, the data in Table II are for the most part been taken from the *Recueils statistiques sur les métaux*, etc., from the "Metallgesellschaft" and "Metallbank und Metallurgische Aktien gesellschaft" of Frankfort-on-the-Main.

In the consumption of sulphate of copper, Italy occupies the first place. A diagram of the consumption of sulphate of copper in Italy shows decided periods of minima which last always two years. These are years in which the favourable weather limits the consumption of sulphate and the vines yield heavily. Such years are usually followed by one in which the vines are still in good condition and do not require excessive care, whilst the vine growers are not inclined to spend much on account of the low prices of copper due to the heavy crop.

It is also to be remembered that statistics do not consider the probable quantities remaining in the hands of small tradesmen and consumers.

(1) 1 metric ton = 0.9842 English ton.



TABLE I. — *Production of*

COUNTRY	1894	1895	1896	1897	1898	1899
United Kingdom (1) . . . . .	36 207	40 091	53 464	60 236	53 112	40 839
Italy . . . . .	2 982	3 151	4 756	5 337	6 164	7 791
United States (2) . . . . .	—	21 700	22 100	23 600	25 000	30 800
France (3) . . . . .	—	—	—	—	—	—
Austria (3) . . . . .	—	—	—	—	8 300	9 200
Germany . . . . .	4 809	4 638	6 838	6 400	4 838	5 700

(1) As it is impossible have precise information on the production of the English

(2) These figures are taken from *The Engineering and Mining Journal* and include the

(3) Approximate data from a private enquiry made by the Metallgesellschaft an

TABLE II. — *Consumption of sulphate of copper (in metric tons).*

COUNTRY	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
Italy . . . . .	42 700	54 500	56 600	59 200	60 400	66 900	36 500	49 150	81 400	58 100
France . . . . .	—	—	—	—	21 800	36 800	32 300	31 900	34 900	36 700
Austria . . . . .	11 800	14 400	13 900	12 200	14 970	19 700	14 390	15 160	20 690	31 200
Germany . . . . .	5 000	6 100	7 300	5 500	7 800	9 200	11 500	7 100	8 300	12 200

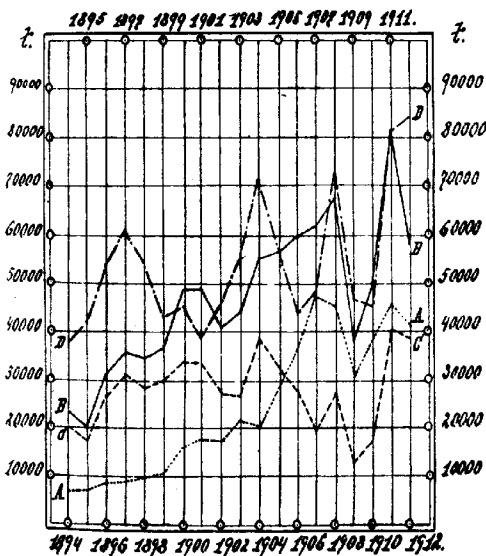
(in metric tons).

	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
000	54 300	71 400	56 800	43 600	46 000	72 400	45 600	43 400	81 100	85 500	
600	18 164	17 237	26 212	34 276	45 264	42 598	28 551	36 236	43 626	40 000	
800	19 600	28 800	24 000	23 200	20 400	17 200	20 400	12 400	15 200	18 000	
—	—	—	—	—	15 000	24 000	25 000	26 000	25 000	26 000	
200	8 300	10 000	10 200	10 400	11 000	11 400	10 300	11 800	14 100	15 200	
200	5 200	6 584	6 988	6 758	5 284	7 117	6 211	5 209	7 500	8 700	

the quantities exported are here given.

obtained as a by-product in the metallurgical works which treat copper ores,  
of Frankfurt-on-the-Main.

Consumption of sulphate of copper in Italy from 1895 to 1911 (in metric tons),  
compared with exportation from England, etc.



A. Production of sulphate of copper in Italy. — B. Consumption in Italy. — C. Importation into Italy. — D. Exportation from England.

These stocks, which would weigh heavily on the statistics, come into play in producing the apparent diminished consumption observed in the years following an abundant crop. It follows that the increase of consumption rarely increases abruptly after a year of minimum consumption. Independently of any other cause, it is very probable that the ratio between the consumption of 1913 and that of 1914 will be the same as that between other periods of minima, as 1898-99, 1902-03, 1909-10.

- **Criticism of the Experiments on the Influence of Atmospheric Electricity on Plants.** — LESAGE, PIERRE in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 157, No. 18, pp. 784-787. Paris, November 1913.

The retardation in the growth of plants under metallic cages was supposed to be due to their protection from atmospheric electricity. Experiments were carried out with cress and also with *Datura Tatula*, and to eliminate the effect of the cage structure a batch of plants were grown in a cage of exactly similar dimensions to the iron wire cage containing a similar batch of plants. At the end of the three months the plants in the control batch grown in the open air were distinctly larger than the others, but there was no perceptible difference between the plants grown in the different cages. Further experiments on the evaporation of water from a plain surface showed that a cage of small mesh decreased the rate of evaporation by 30 per cent. in still air and by about 30 per cent. in moving air. It would therefore appear that the effect of the cage in diminishing the rate of growth is explained on other grounds than the removal of the influence of atmospheric electricity, even supposing this to exert any influence at all.

110 - **Studies on Differential Mortality in the Germination of Bean Seeds.** HARRIS, J. A. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 683-700; No. 564, pp. 739-759. New York, November and December 1913.

The mortality of seeds in field cultures of *Phascolus vulgaris* is not random, but selective with respect to seed weight. Both large and small seeds are less capable of developing into fertile plants and are more heavily drawn upon in the mortality than seeds of the modal region of the seed weight distribution. The mortality of the two extremes, however, is so evenly balanced that the mean weight of the survivors does not differ from that of the whole population, while the variability is reduced.

Additional experiments have been made with 46,000 seeds under laboratory conditions to test the above conclusions. These experiments show that in some varieties the heavier, in others the lighter, seeds are most heavily drawn upon in the mortality and that there is a real biological relationship between weight and viability.

The writer has also shown that in general the larger seeds require a longer time for germination, but the relation of this to selective mortality is still to be worked out.

- On the Assimilation by Plants of Nitrogen in the Form of Tyrosine, Leucine and Witte's Peptone. — PETROV, G. G. in *Izvestia Moskovskogo Selskokhoziastvennogo*, Year XIX, No. 5, pp. 163-183 + fig. 4. Moscow, 1913.

The writer grew maize plants inside large glass cylinders which were airtight and through which a stream of air containing 1 per cent. carbon dioxide was continually passed at the rate of 100 litres per day. The plants were supported on a wire netting and their roots dipped into a nutrient solution. The whole apparatus including the solution was sterilized by heating before being used and the seeds were immersed in a 1 per cent. bromine solution — the efficiency of the sterilization being proved by the fact that no micro-organisms were present in the jars at the end of the experiment. The jars were kept in diffused light for from 40 to 64 days.

The nutrient solution in each jar received one of the following nitrogenous compounds: tyrosine, leucine, Witte's peptone, calcium nitrate. At the end of the experiment the plants were carefully weighed and analysed for total and albuminoid nitrogen, for asparagine, and for ammonia.

From the results thus obtained and other existing data relevant to the subject of nitrogen assimilation by plants, the writer draws the following conclusions:

- 1) Both amino acids (tyrosine and leucine) and Witte's peptone are absorbed by plants and the nitrogen they contain is assimilated; plants are therefore capable of absorbing not only amide but also amine nitrogen.
- 2) The increase of dry matter and the quantity of nitrogen assimilated by plants fed on the three above substances present two parallel series of results, in both of which the peptone plants are first in order and the tyrosine plants last.
- 3) Root development is impeded by solutions of the following concentrations: leucine 0.04 per cent., tyrosine 0.05 per cent., and peptone 0.03 per cent. In these concentrations, while peptone only arrests slightly the development of lateral roots, leucine and more especially tyrosine hardly allow any development of the root at all.
- 4) Leucine, and to a still greater degree tyrosine, cause a shortening of the roots with an accompanying thickening of the cellular membranes and subsequent abnormal thickening of the roots themselves.
- 5) As a result of both the present and past experiments with ammonia, asparagine, and calcium nitrate, an inverse ratio is shown to exist between the amount of asparagine and albumen contained by the roots and by the shoots. This confirms the writer's opinion that ammonia absorbed or formed by plants is temporarily changed into asparagine, which later forms a nucleus for the elaboration of albumen.

- Individual Variation in the Alkaloid Content of Belladonna Plants. — HAYES, A. in *The Journal of Agricultural Research*, Vol. I, No. 2, pp. 129-146. Washington, November 1913.

Analyses of the alkaloid content of the leaves of individual plants of *Belladonna* at various stages of growth and in different seasons

1) That the leaves can be picked to best advantage from the time of flowering until the early berries begin to ripen. Although the leaves are richer in alkaloids later in the season, they are then too small and sparse for harvesting.

2) That no correlation exists between the general appearance of the plant and the alkaloid content of its leaves, and that luxuriant growth is by no means a criterion of the medicinal value of the plant.

3) That considerable variation exists in the alkaloid content of different plants, thus making it difficult to determine to what extent soil and climate influence the development of alkaloids.

4) That the variation of the alkaloid content of different plants continues in the same direction during different seasons.

113 - **Effects of Illuminating Gas on Vegetation.** - STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, Part pp. 45-60 + 2 plates. Boston, January 1913.

The injurious effects of illuminating and waste gases on vegetation have been studied in considerable detail by the writer. In the case of the Carolina Poplar (*Populus deltoides* Marsh) the characteristic toxic effect consists of a splitting of the bark and a swelling of the tissues, and later, exudation of slimy mucilage. During the incipient stages the poisonous constituents of the gas appear to have a direct stimulating effect on cell division.

Experiments with willow cuttings grown in water charged with illuminating gas showed that:

1) The development of new shoots and roots began from 4 to 5 days earlier than in ordinary tap water.

2) When the water is charged with the gas more frequently, no further increase of development occurs, but the symptoms of gas poisoning appear earlier.

3) The stimulation of the roots is more vigorous than that of the shoots, the increase in length of the former exceeding 600 per cent., while that of the latter is about 200 per cent.

The increased root development is attributed to the attenuation of oxygen in the water, and this theory is supported by the increased development of the lenticels under the action of the gas.

The effect of illuminating gas on dormant willow cuttings was also tried, and it was found that the development of the cuttings was accelerated by treatment in an atmosphere of the gas of from 24 to 72 hours duration.

114 - **Variations in Osmotic Pressure in Potatoes during Storage.** - BRADSHAW, M. A. in *The Botanical Gazette*, Vol. LVI, No. 5, pp. 433-438 + figs. 1-4. Chicago, November 1913.

In studying the changes taking place in potatoes during storage observations of the variations in osmotic pressure afford interesting information. Determinations were made in a Beckmann apparatus according to Hamburger's method.

The results showed that :

- 1) Heat is a factor controlling the processes which give rise to the changes causing variation in the osmotic pressure of potato sap.
  - 2) Low temperatures increase the osmotic pressure and also the rate, which appears to be the controlling agent in the release of the enzymes hydrolysing starch and hemicellulose.
  - 3) The carbohydrates hydrolysed furnish the energy required by the potato in carrying on its metabolism during cold storage.
- Examination of the cell structure of stored potatoes showed that at low temperatures the cell walls become thinner and more brittle, while with an increase of temperature they became tougher.

**The Inheritance of Blossom Colour in Beans (*Phaseolus*).** — SHAW, T. K. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, Part I, pp. 182-203 + 1 plate, Boston, January 1913.

This paper is an account of five years' work on the inheritance of blossom colour in beans (*Phaseolus*). The results so far obtained appear to point to a correlation between blossom colour and seed-coat colour, and it is expected that more complete analysis of the 1913 results will clear up many uncertainties concerning the inheritance of blossom colour.

**Seed Selection of Egyptian Cotton in Arizona.** — KEARNEY, T. H. — *Bulletin of the U. S. Department of Agriculture*, No. 38, 8 pp. Washington, November 19, 1913. Many varieties of Egyptian cotton have been introduced into Arizona for purposes of acclimatisation and plant breeding. One of these, *Mit*, was cultivated and selected for some five or six years, but without improvement. In 1908, however, a superior type appeared amongst the progeny and gave rise to a new variety possessing large bolls and long green-coloured fibres and quite uniform in its progeny. This variety, known as Yuma, is now grown extensively in the Salt River Valley; it recently originated as a mutation, and, although it breeds true, it is of great importance to adopt measures to prevent deterioration by cross-fertilization with foreign varieties and by the appearance of inferior mutants. This work can best be done under the guidance of the local Cotton-growers' Associations and the Department of Agriculture.

**The Breeding of Medicinal Plants.** — MILLER, F. A. in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 193-201 + 2 figs. Washington, D. C., December 1913. The selection of medicinal plants yielding higher percentages of their active drugs offers a rich field of development. The chief difficulty encountered in such work is the testing of individuals by long and expensive chemical and physiological assays, but this can be overcome, in part at least, by seeking correlations between high potency and certain morphological characters.

Amongst medicinal plants that have been improved by this process the following :

Plant.	Yield of alkaloid.						Remarks.
	Normal			After selection			
	Min.	Max.	Average	Min.	Max.	Average	
<i>Atropa Belladonna</i> leaves and roots. .	0.23	0.62	0.43	0.55	0.87	0.72	External characters of plant are extremely variable except yield of leaves and roots, the dry matter of which varies from 139 gms. to 141 gms. between different individuals.
<i>Datura Stramonium</i> and <i>D. Tatula</i> . .	—	—	0.34	0.46	0.55	—	
			0.35	0.47	0.65	—	
			0.47	0.44	0.57	0.51	
			0.65	0.43	0.77	0.65	

118 — **The Classification of Cultivated Rice.** — 1. KIKKAWA, S. in *Journal of the College of Agriculture, Tokyo*, Vol. III, No. 2, pp. 11-108 + plates 5-8. Tokyo, 1922.  
2. GRAHAM, R. J. D. in *Memoirs of the Department of Agriculture in India, Botany Series*, Vol. VI, No. 7, pp. 209-229 + plates 1-4. Calcutta, December 1913.

1. — The writer has had the opportunity of examining rices from all the more important rice-growing countries in the world and constructs a more complete and detailed classification. He includes a brief summary of the attempts of previous workers in this field, concluding with a more detailed account of Tanaka's classification published in 1900. He follows Tanaka's system in somewhat greater detail and bases his classification on those characters, morphological and otherwise, which are important from an agricultural point of view.

It is divided into two parts, one based on differences in cultivation and the other on the utility of the grain.

#### THE CLASSIFICATION OF RICE WITH REGARD TO ITS CULTIVATION.

- (A) Aquatic rice.
  - (a) Early. (b) Medium. (c) Late.
    - (I) Ordinary rice.
      - (α) Tall. (β) Medium tall. (γ) Short.
      - (1) Awned. (2) Awnless.
    - (II) Special rice.
      - (α) Giant. (β) Salt rice.
- (B) Upland rice.
  - (a) Early. (b) Medium. (c) Late.
    - (α) Tall. (β) Medium tall. (γ) Short.
    - (1) Awned. (2) Awnless.

Since the duration of growth of particular rice varies according to the local conditions, any classification including this character must be special for each locality. Results are given showing the existence of correlation between length of stem and its power, and between length of stem and weight of ear. Giant rice measure above 2 metres in height, and salt rice possess resistance against injury from sea water.

Other factors considered in this classification are :

1. Colour of glumes and awns.

No correlation exists between the colours of the various parts of the unhulled grain.

2) Colour of the stem and leaf.

3) Long-glumed rice.

These rice have very long empty glumes, sometimes exceeding the flowering glumes.

4) Double rice.

Varieties containing more than one ovary in a spikelet.

5) Form of panicle.

6) Colour of stigma.

#### CLASSIFICATION OF RICE WITH REGARD TO THE UTILITY OF THE GRAIN.

This classification divides the varieties into two groups, the non-glutinous and the glutinous, each of which is subdivided as follows :

Slender-grained. (II) Long-grained. (III) Short-grained.

1) Large-grained (2) Medium-grained (3) Small-grained.

(a) Common-coloured.

(α) Ordinary. (β) Scented.

(b) Specially coloured.

Glutinous rice contain sugar and dextrin and are only used in confectionery. The non-glutinous rice are the ordinary table rice.

Rice are classified according to their dimensions as follows: ratio length: breadth  
slender-grained;  $< 3$  and  $> 2$  = long-grained;  $< 2$  = short-grained; the product  
length  $\times$  breadth  $> 18$  or  $19$  = large-grained,  $< 15$  or  $16$  = small-grained.

Other important characters are :

1) Shape of the hulled and unhulled grains.

This character has some connection with the taste and process of whitening.

2) White-abdomened rice.

This is the name given to those rice possessing a white chalky-looking portion in the middle of the ventral side, that is the side of the grain in which the embryo is situated. Such grains are more easily broken and have a lower specific gravity.

This scheme is adopted in the classification of Burmese rice, which the author gives in an appendix of 76 pages.



2. — This is a preliminary note on the progress of the work of the last years on the classification of the rices of the Central Provinces, India, includes an introductory account of the acreage under rice and the character of the soils in this area.

The classification adopted follows somewhat the lines of that of Kawano, but gives more attention to characters of no direct agricultural value such as the colour of the ligules and sickles (auricles), the length of the peduncle, the type of inflorescence (whether erect, curved or drooping), the arrangement of the spikelets, the shape of the rachilla, and the character of the apiculus and awn.

The writer gives a classification of a number of non-glutinous rices of the Central Provinces, based chiefly on their vegetative characters and to a less extent on the dimensions of the grain and spikelet.

119 — **The Gases of Swamp Soils; their Composition and Relationship to the Growth of the Crop.** — HARRISON, W. H. and SUBRAMANIA AYYER, P. A. in *Mem. of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 3, pp. 65, plates 1-4 + figs. 1-6. Calcutta, October 1913.

Considering the apparent inconsistencies in the customs of the natives with regard to the time and manner of applying green manures to their paddy fields, it seemed desirable to make a detailed study of the conditions of growth in such soils before any guidance or improvements could be suggested. With this object in view, a study of the soil gases was undertaken as being the most promising field of enquiry.

Disturbance of the soil puddle in paddy fields liberates the soil gases which bubble through the irrigation water. Analysis of these gases shows that they consist chiefly of methane and nitrogen in widely varying proportions, with small and variable amounts of carbon dioxide, oxygen and hydrogen. A study of this variation showed that before planting the proportion of methane is high and that of nitrogen low, while at planting the seedlings, the proportions of the gases are reversed, hydrogen being in excess. This continues until the ripening of the crop after which stage the proportions of methane and nitrogen approach those of an uncropped soil.

Analysis of the soil gases immediately after flooding the fields shows that the anaerobic condition commences within a few days, and before planting out.

These experiments lead to the conclusion that the plant absorbs supplies of nitrogen in the form of ammonia and nitrogenous organic compounds, and that the crop restricts the formation of methane and hydrogen either by retarding the rate of fermentation or by the absorption by the roots of a portion of the intermediate products of decomposition.

Analysis of the surface gases showed that they consist of oxygen and nitrogen; carbon dioxide, methane and hydrogen were absent. Studies of the variation in composition of these gases showed that during the period of active growth of the crops the percentage of oxygen was reduced, and that the application of organic manure increased the production of oxygen, while destruction of the algal slime by means of copper sulphate solution

siderably decreased it. Decreased production of oxygen was also associated with a decreased production of nitrogen.

These experiments lead to the conclusion that the roots of the rice absorb oxygen and that most of this oxygen is produced by the algal slime in the water, excess of oxygen being evolved in the form of bubbles which the nitrogen dissolved in the water diffuses according to Dalton's law. The increased activity of the slime organisms, due to the decomposition products of the organic matter in the soil, results in an increased out-put of oxygen and a consequent greater root activity of the crop.

Artificial drainage and aeration of the soil increases the root development within narrow limits, beyond which destruction of the algal slime takes place and nitrification probably begins. The beneficial effects of artificial drainage appear to be due to the removal of toxic decomposition products and aeration of the roots. The writers are therefore led to conclude that the drainage of paddy soils requires very careful consideration except in toxic soils is better replaced by a natural system of root aeration effected by green manuring and the development of the algal slime.

- **The Sweet Potato as a Cover Crop in Coconut Plantations.** - SCHAEFFER, G. *Entretien économique d'une jeune cocoterie.* - *L'Agronomie Coloniale*, Year I, No. 5 pp. 136-137 + 2 plates. Paris, November 1913.

During a visit to the Malay States in 1913, the writer saw young coconut plantations in which sweet potatoes (1) were grown as a cover crop in black peaty soils with excellent results.

The advantages of this crop are: 1) its rapid growth and spreading habit, giving complete protection to the soil; 2) reduction in expenses of cultivation; 3) natural decay of the plant when the trees reach maturity.

- **Cotton Cultivation and the Cotton Industry throughout the World.** - WOEIKOF, A. in *Annales de Géographie*, Year XXII, No. 126, pp. 385-398. Paris, November 15, 1913.

The average yield of cotton from each country during 1907-10 is given in the following table:

	Millions of tons.	Percentage of total.	Yield per acre.
United States . . . . .	2 454	62.2	180 lbs.
France . . . . .	695	17.7	72 lbs.
Italy . . . . .	292	7.4	410 lbs.
German Empire . . . . .	172	4.3	—
Spain . . . . .	132	3.4	—
India . . . . .	76	1.9	—
Japan . . . . .	22	3.1	—
China . . . . .	26		—
Portugal . . . . .	16		—
Other Countries . . . . .	15		—
	42		—
Total	3 942		

1) The sweet potato (*Ipomoea campanulata*) or « Ubi », is a favourite vegetable of the Asiatic races of the Malay Peninsula. (Ed)

The value of the world's total production of cotton is about 230 millions sterling. The most important producing country is N. America, but its further development is hindered by unsuitable climatic conditions in the north and south and the scarcity and dearness of labour, the latter being an almost insuperable difficulty. Further development in Egypt is also impossible except in the higher regions, which will only produce inferior varieties of cotton.

Besides, these countries have reached their highest yield per acre. In 1901-02 the yield per acre in Egypt was 460 lbs. per acre, while in the years 1908-10 it had fallen to 370 lbs.

The ideal conditions required for successful cotton cultivation are: a) a soil with abundant moisture; b) a low rainfall; c) abundant sunshine; d) a humid atmosphere, and e) an abundant supply of labour. These conditions are to be found in Asia, particularly in India, Turkestan and Mesopotamia, and it is in these countries that future developments in the cultivation of cotton will take place. Some parts of Nigeria abundantly supplied by the Niger also offer great possibilities of development in this direction, almost equal to those of Mesopotamia.

#### 122 - Studies of the Primary Market Conditions of Cotton in Oklahoma.

SHERMAN, W. A.; TAYLOR, FRED; and BRAND, C. J. — *Bulletin of the U. S. Department of Agriculture*, No. 36, pp. 1-36. Washington, D. C., November 15, 1913.

The system of handling and marketing cotton in vogue today has become extremely complicated owing to the needs and demands of the middlemen, who at best have only a temporary interest in the product, while the claims of the grower and the requirements of the consumer are more or less ignored. This investigation was undertaken in Oklahoma to obtain information of the state of things and the various factors controlling the market price of cotton. The questions investigated on behalf of the grower comprise the following:

- 1) The proper grading of the cotton.
- 2) The premium obtained for the higher grades.
- 3) Unjust reduction for low grades.
- 4) Variations in market price from town to town.
- 5) Variations in local markets.
- 6) Relation of farmer's selling price to spinner's buying price.

The investigations were carried out in 103 towns; over 3 200 bales of cotton were sampled and graded, and records were made of the date, place of sale and price paid to the grower. No evidence was obtained that special attention is paid to the variety of short-staple cotton when fixing the price, and the only characters of an improved variety that are of any value to the grower are its yield and its percentage of lint.

The results of the investigation are summarised as follows:

- 1) The ginners pay nearly the same for all cotton purchased on a given day, whether buying in seed or in the bale.
- 2) In street markets where there are large numbers of buyers, widely differing prices are paid on the same day for bales of identical quality.



The profits from a central factory, including interest on capital, insurance and depreciation, work out at 7.3 per cent. on the capital outlay which for a factory sufficient for 600 bighas (523 acres) is estimated at 87 3/4 Rs., or about £ 5 820.

Details are also given of the cost of labour and the various operations under local conditions.

The seed should always be imported fresh, as it loses its superiority after three years' acclimatization. A three-course or four-course rotation with rice, Rabi crops or indigo gives very good results. Manuring with superphosphate appears to improve the yield of fibre and tow.

124 - **The Present System of Grading Abaca (Manila Hemp); its Defects and Remedy.** — SALEEBY, M. M. in *The Philippine Agricultural Review*, Vol. VI, No. 12 pp. 504-512 + 4 plates, Manila, P. I., October 1913.

Any system of grading in order to be complete and in accordance with the requirements of the consuming market must include the consideration of the colour, strength, length and texture of the fibre. Colour and strength are the most important qualities considered in the lower grades, while the length is ignored unless decidedly below 1 1/2 meters.

The colour is dependent upon the method and degree of cleaning and drying and on the position of the sheath in the stalk. The strength of the fibre is also dependent upon these factors, as well as on the variety of the plant, while the texture is chiefly dependent on the variety of the plant and the soil and climatic conditions. The sheaths of every stalk vary in colour and size, thus causing corresponding changes in the fibre but the number of grades adopted in commerce is far in excess of the natural variations of the plant and of those due to the methods of preparation. This difference in the interpretation of the same grade between two different establishments is often as great as that between two consecutive grades or marks of the same firm.

To protect the industry from this confusion, the writer recommends the adoption of a Government system of grading.

125 - **The Experimental Error in Sampling Sugar-Cane.** — LEATHER, J. W. in *Memoirs of the Department of Agriculture in India*, Vol. III, No. IV, pp. 107-118 Calcutta, October 1913.

Determinations of the sucrose content of individual canes showed that the probable error of the mean of 120 determinations was  $\pm 0.17$  per cent. It follows therefore that the error of the determination of a sample of 120 canes will not exceed  $\pm 0.5$  per cent. in more than 1 case in 20.

Since the accuracy of a sugar-cane determination does not exceed 0.1 per cent., the determination of a sample of 120 canes will give reliable results.

Selections of canes from different parts of the same plots not exceeding 1 acre in area were made, and it was found that the probable error in such cases was no greater than that of a selection of canes from one definite position, showing that the variation due to soil over an area up to 1 acre was negligibly small compared with that due to individuality amongst the canes.

**- Yield and Returns from Palm Oil Trees in French Guinea.** — NICOLAS, L. in *L'Agronomie Coloniale*, Year I, No. 5, pp. 138-143. Paris, November 1913.

Experiments on the preparation of palm oil from *Elaeis Guineensis* the native method during 1911-12 have given the following results:

*Total yearly production from 590 trees:*

*Fruits.*

No of bunches of fruit . . . . .	2 521	
Total weight . . . . .	44 300	lbs.
Total weight of fruit . . . . .	25 570	»
Average weight of fruit per bunch . . . . .	10.1	»

*Oil.*

Total weight of oil extracted by native method . . . . .	2 073	»
Average weight of oil per bunch . . . . .	0.82	lb.
Percentage of oil extracted from fruit . . . . .	8.1	

*Palm nuts.*

Total weight of palm nuts obtained . . . . .	16 208	lbs.
Average weight of palm nuts per bunch . . . . .	6.43	»
Percentage of palm nuts in the fruits . . . . .	63.4	

*Kernels.*

Total weight of shelled kernels . . . . .	4 528	lbs.
Average weight of kernels per bunch . . . . .	1.86	»
Percentage of kernels in the fruit . . . . .	17.7	
Percentage of kernels in the palm nuts . . . . .	27.9	

Analysis of the results obtained from the harvests at different times the year shows considerable variation in the yield of oil and nuts. In May yield of fruit is much less than in October and January, but the percentage of fruit per bunch and the percentage of oil obtained from the fruits is much higher, whilst the percentage of nuts in the fruits is much less.

*Annual returns from a plantation of 590 trees:*

	£ s
2073 lbs. of oil at nearly 3 d per lb. (at Conakry) . . . . .	24 5
4528 lbs. of kernels and 2200 lbs. of kernels gathered from the ground beneath the trees, making a total of 6728 lbs. of kernels at about 1 ½ d per lb. (at Conakry) . . . . .	42 8
Total income from 590 trees . . . . .	£ 66 13

Corresponding to a return of 2 s 3 d per palm tree in bearing.

**- Tapping Ceara (*Manihot Glaziovii*).** — DE WILDEMAN, E. A propos du Manihot. — *Le Caoutchouc et la Gutta Percha*, Year 10, No. 117, pp. 7773-7774. Paris November 15, 1913; after ARENS, F. in *Mededeelingen van het Proefstation Malang*, No. 6. Malang, 1913.

Manihot seems to be advisable where Hevea does not thrive; consequently Dr. Arens has attempted to determine the best method of tapping. He considers that the half fish-bone as practised on Heveas gives the best results, at least in Java. The yield of the daily tappings is 15 grams

for four-year-old trees, a workman being able to tap 200 trees per day. This method appears to allow the quickest healing of the scar.

The writer attaches much importance to the planing down of the bark where the incision is to be made. He warns against long cuts. The knife to be used is a modification of Burgess'.

128 - **An Improvement in the Method of Preparing Brazilian Rubber.** - CAYLA, M. in *Journal d'Agriculture Tropicale*, Year 13, No. 149, pp. 329-333. Paris, November 1912.

F. Ripeau has invented a metallic cylinder to replace the stick of "seringueiro" in the preparation of Brazilian rubber. It consists of an aluminium cylinder rotating about its horizontal axis. The latex is sprayed onto the cylinder and exposed to the action of smoke. The rubber is removed from the cylinder in sheets of about 3 to 5 mm. ( $\frac{1}{8}$  to  $\frac{1}{4}$  in.) thick.

The advantages claimed for this method are:

- 1). Rubber of Fine Hard Para quality is obtained without its impurities.
- 2). The purity of the rubber effects a saving in transport.
- 3). The cylinder, light in weight, is worked by hand and easier to manipulate than the large rollers formerly used.
- 4). Reduction in labour; 12 litres (2  $\frac{1}{2}$  gallons) of latex can be coagulated in 1 hour by this method as against 1  $\frac{3}{4}$  hours by the native method.

129 - **The Standardisation of Plantation Rubber.** - Report of the Rubber Growers' Association, in *India Rubber Journal*, Vol. XLVI, No. 24, pp. 19-24. London, December 13, 1912.

To remedy the unsatisfactory condition of prices for plantation rubber, the Rubber Growers' Association recommends the establishing of a central testing station and the adoption of an approved scheme of standardisation as a basis for determining the market prices of the different grades.

The proposed tests are to comprise: 1) determination of vulcanising capacity (rate of cure); 2) tests on the vulcanized product, determining tensile properties, physical condition and stability. A high quality of plantation rubber is to be taken as standard quality with an index figure of 1000, inferior grades to be indexed in relation to this standard.

By the adoption of this system of indicating the quality of the rubber to the seller (*i. e.* the producer) and the value to the buyer, the Association hopes for a material appreciation of prices all round compared with prices for finest grades of wild rubber.

130 - **Manuring Tobacco by Spraying the Leaves with Solutions of Potash Salts.** - COLOMAN, KERPÉLY in *Köntelek*, Year 23, No. 4, pp. 3330-3331. Budapest, December 24, 1913.

Professor L. HILTNER, Director of the Agricultural Botany Institute of Munich, has drawn the attention of agriculturists to a new manner of using potash salts. He demonstrated in 1911 that potash salts (sulphate and chloride) in suitably diluted solutions, if sprayed onto growing plants, penetrated into them and were absorbed (1). The effects of repeated

(1) HILTNER, L. Ueber eine neue Verwendungsmöglichkeit für Kalisalze und andere düngender Stoffe. - *Mitteilungen der Deutschen Landwirtschafts Gesellschaft*, 1911, Stück 19, 231.

ing were in so far favourable that the plants submitted to the treatment developed more vigorously and gave a higher yield than those not so treated. HILTNER's experiments were mostly made on white mustard, beans and potatoes.

In Hungary the Royal Tobacco Experiment Station at Debreczen conducted a series of experiments with the object of ascertaining whether this method could be applied to the cultivation of tobacco. The experiments

in 1911 gave negative results on account of the unfavourable weather; they were repeated in 1912, using the large-leaved Szegedi Rózsa variety and the small-leaved selected garden Réthát tobacco, on 662 sq. yards in extent. Three weeks after the striking of the plants that had been transplanted (June 11) spraying was commenced, a 1 per cent. solution of sulphate of potash being applied by a common sack sprayer. The operation was repeated every seven days up to July 24.

At the same time comparative experiments were made between morning spraying after the dew had evaporated and evening spraying before night-fall.

In 1912 the weather was favourable to tobacco, as the rains did not fall in Hungary before the middle of August when the plants were already flowering and consequently did not cause any trouble, except during the hot and drying weather. Whilst spraying, care was taken to wet the whole surface of the leaves. With the growth of the plants the treatment involved more labour and proportionately a greater quantity of solution.

With the variety Szegedi Rózsa, planted at distances of  $20 \times 28$  inches (11 200 to the acre), the work was quicker and less expensive than with the Réthát variety planted closer ( $12 \times 20$  inches or 27 624 to the acre), as may be seen in Table I.

TABLE I.  
*Time and quantity of liquid employed in spraying plots of 662 square yards.*

Date of spraying	Szegedi Rózsa			Réthát		
	Labour		Liquid used — gallons	Labour		Liquid used — gallons
	hours	minutes		hours	minutes	
11 . . . . .	2	—	21.12	5	20	40.48
18 . . . . .	2	50	35.20	8	—	59.84
25 . . . . .	3	20	42.24	8	40	73.04
2 . . . . .	4	40	56.32	12	40	114.40
9 . . . . .	5	20	75.68	16	—	132.00
16 . . . . .	10	—	119.68	16	—	142.56
23 . . . . .	12	—	132.00	17	—	158.40
Total of sprayings . . .	40	10	482.24	83	40	720.72



The expense per acre based on the above data works out as follows:

	Tobacco					
	Szegeði Róssa			Rétthát		
	£	s	d	£	s	d
Labour . . . . .	2	12	7	5	12	4
Sulphate of potash . . . . .	3	17	4	5	14	10
Drawing water, preparation of solution, carriage, etc. . . . .	1	19	2	2	16	2
Total . . . . .	£8	9	1	£14	3	4

This shows the expense per acre to be considerable for both varieties and distances of planting.

The effect of spraying appears in the more vigorous development of the plant, the greater length of the stems, the more numerous leaves and the fresher colour. This difference was more specially noticed on the plants treated in the morning, while in those sprayed in the evening it was less conspicuous. This fact confirmed the opinion of the writer that the absorption of potash by the leaves was more active in the morning, when the process of absorption begins, than in the evening, which opinion is corroborated by the data on the yields, given in Table II.

TABLE II.

	Plots of 662 sq. yds.	Per acre	Increase of yield per acre	Average number of leaves per stem	Combustibility of the leaves per small
	lbs.	lbs.	lbs.		
<i>Szegeði Róssa variety.</i>					
Without spraying . . . . .	226.2	1593.70	—	12.2	20
Morning spraying . . . . .	339.2	2390.07	796.37	17.5	48
Evening spraying . . . . .	277.6	1856.47	362.77	14.7	44
<i>Rétthát variety.</i>					
Without spraying . . . . .	287.5	2026.22	—	15.5	13
Morning spraying . . . . .	426.8	3007.56	981.34	18.1	22
Evening spraying . . . . .	367.4	2588.98	562.76	16.6	21

It appears from the above that spraying 2 per cent. sulphate of potash solution improved the combustibility of the leaves and increased the yield especially when the spraying was done in the morning.

Table III shows the financial results of the treatments.

TABLE III.

Variety of tobacco	Cost of spraying per acre	Value of greater yield			Deficit per acre		
		£	s	d	£	s	d
Egeli Róza . . . . .	8 9 1	morning	6	15	5	1	13 8
		evening	3	1	7	5	7 6
Hbat . . . . .	14 3 4	morning	11	2	4	3	1 0
		evening	6	7	5	7	16 0

The final result of the experiments is a loss, in spite of the considerable increase obtained in consequence of the morning spraying and the very favourable weather of 1912.

The writer concludes that the favourable effect of spraying with potash solution under favourable climatic conditions is undeniable, but that the necessary expense is so great that this method will be of no practical importance for tobacco growers.

1 - **Experiments in Bulb Growing in the United States.** - DORSETT, P. H. - *Bulletin of the U. S. Department of Agriculture*, No. 28, pp. 1-21 + figs. 21. Washington D. C., November 1913.

Bulb growing has been attempted in various parts of the United States, it with very doubtful success until recently, when the Department of Agriculture opened an experimental bulb garden on a selected plot of ground at Bellingham, Wash. At this station bulbs for forcing have been grown superior to the best imported Dutch bulbs; but when these are grown in other parts of the United States, the same deterioration sets in subsequent years as with imported bulbs. Experiments are also being conducted with machinery with a view to reducing the cost of production.

It appears that the success of bulb growing in the United States depends chiefly on the suitability of soil and climate.

2 - **Present State of Fruit Growing in Greece.** - Communication from J. BRICHET, *Fruit Specialist to the Royal Ministry of Agriculture, Agricultural Station of Patras*.

With the development of Greece, both economic and social, there has been a steady development in fruit growing. This growth has been brought about by private enterprise and by the assistance of arbor societies, sometimes supported by the authorities; and although the plantations are not so extensive as in some other parts of Europe, their utility has none the less been realised.

The size and nature of the fruit plantations, now fairly abundant, varies according to the district and the suitability of the particular species for the spot. The Greek is not a systematic cultivator and if he sometimes

reaps great profit from his trees, he owes it entirely to the nature of the climate of certain favourable neighbourhoods. Cultural methods other than simple tillage and manuring are neglected. Notwithstanding this, handsome crops are often obtained. On the slopes of Pelion crops of as much as a ton of juicy apples are gathered from a single tree, while in the district of Patras and in the Valley of Leonidion in Arcadia pear trees as big as planes may produce each 6 or 8 cwt. of pears. In the Eparchy of Lepanto and in the Peloponnesus, on the slopes of Mt. Chelmos, huge quantities of walnuts are found yielding prodigious quantities of fine nuts.

From the fruit growers' standpoint Greece may be divided into two zones: one, the maritime and littoral zone, has a fairly temperate climate and comprises the islands, the slopes of the mountains facing the sea, and sometimes cut into by deep and very fertile valleys, and the generally low and often extensive plains between the mountains and the sea; the other, the inland zone, is mountainous and consists of plateaus and narrow valleys at a height of 400 to 1000 m. (1300 to 3300 ft.), with great extremes of climate.

In the most favourably exposed parts of the former zone are found all the citrus fruits (including citrons), as well as almonds, pistachios, Japanese medlars, peaches, carobs, figs, pomegranates and pears on quince stock. In the latter zone, pears on pear stock, apples, walnuts, cherries, apricots, plums, peaches on plum stock, and agriots are cultivated with success.

Owing to the lack of systematic cultivation and technical knowledge, pomology is still in an elementary condition. Most of the varieties, except those recently introduced from other parts of Europe by the Ministry of Agriculture and a few private individuals, are modifications of native varieties produced by changes in climate and stocks upon which they are grafted. They are so numerous and are given such different names in different localities that it is very difficult to classify them. They include some exquisite fruits with heavy cropping powers when systematically cultivated, whose preservation, when local consumption or exportation is not adequate for their utilisation in a fresh state, should prove a profitable industry.

At present fruits are chiefly grown to supply local needs, as in the absence of technical knowledge concerning the production of high-class fruit and its preservation and packing, the export trade is not as important as it should be. The exportation is so far almost confined to citrons from the Islands and the Gulf of Corinth (sent to America), lemons from Paros and Messenia (for England and Russia), and apples from Pelion (for Egypt and the Asiatic coast). Generally most of the fruit is consumed in Greece, Athens taking the bulk and the choicest. Patras, Volo, Chalcis, Lamia, Aigion, Calamata and Nauplia are the chief centres for the producing districts. The price of fruit often reaches exorbitant figures in the market of the capital.

Since the foundation of the Ministry of Agriculture nearly three years ago, there has been a sustained effort towards utilising the natural resources of the Country by developing fruit trees, which form the crop most suited to the somewhat capricious climate. The appointing of French

specialists, the creation of large nurseries to provide growers with suit-trees at reduced rates, the introduction of varieties of greater value, reation of posts of itinerary instructors to supply the cultivator advice and information, have all contributed to the rapid development it growing.

fruits grown in Greece are superior to the same varieties grown in parts of Europe in taste and colour. Among pears, the varieties Duchesse d'Angoulême, Epargne, Beurré Diel, Beurré Napoléon and Williams' Bon Jean have been cultivated in Greece for some years and give abundant of succulent fruit with good keeping qualities. Further there exist red here and there throughout the country a few imported varieties since acclimatized and known by the names Bersimi, Canellini, Spino-Campana and Tsakonika, all yielding excellent fruits with good keeping qualities; great quantities are produced in the districts of Patras and Argos in Arcadia. The summer variety Doyenné de Juillet, known in the country as Doukessa, gives an abundance of excellent fruit. They also mention a variety of summer pear very widely distributed in the Peloponnese known as Kontopodaroussa, not of very good quality but ripening early in July, which gives rise to a very important local trade. The varieties of apples are still less known. Besides the excellent and early-cropping variety known as Firiki on Pelion, there are only a few varieties introduced by amateurs and grown in a few gardens. From specimens of Reinette grise du Canada, Calville blanc d'hiver and Rambour d'été which the writer is convinced that they can be cultivated with success in the interior mountainous region.

peaches yield first class fruits and their cultivation properly undertaken give rise to a successful industry in early fruit. Unfortunately the early varieties for export are not yet adopted.

The walnuts from the Lepanto district are renowned for the abundance and quality of their nuts.

cherries, agriots, plums and apricots from all the eastern parts of Greece and the island of Euboea might give rise under rational cultivation to a prosperous preserved fruit industry.

Olives, dessert grapes and figs are superior to those of any other country in the Mediterranean.

With the exception of the vine, these fruits are rarely made the objects of systematic cultivation. The cultivator generally lacks the rudiments of knowledge of how to treat the trees, and continues blindly in old-fashioned methods and prejudices. This difficulty of finding experienced men is a great drawback to amateurs who would wish to spend their time and capital on fruit growing.

The Ministry of Agriculture, with a view to developing fruit growing as a source of national wealth, is about to set up model establishments at Athens and various other centres to carry out: 1) experiments in fruit cultivation, 2) production of trees for distribution on a large scale, 3) experiments with different stocks and varieties and their acclimatization, and 4) the training of skilled men for fruit tree work.

- 133 - **The Pollination of Fruit Trees in relation to Productiveness and** **Pr**  
 HOOPER, C. H. in *The Gardener's Chronicle*, Vol. LIV, No. 1406, pp. 393-394; 301,  
 p. 420, London, December 1913.

The writer gives the results of observations conducted at Wye, & over a period of six years on the blossoming of apples, pears, plums, cherries, with the object of determining:

- 1) The degree of self-sterility or self-fertility.
- 2) The relative order of flowering of the different varieties.
- 3) The most productive pollenisers.

Experiments on the conveyance of pollen by wind in the orchard showed that the quantity is insufficient to pollinate even adjacent trees, and that insects appear to be the chief transport agents. Further experiments showed that insect visitors of fruit consist of 73 per cent. hive bees, 21 per cent. bumble and other wild bees and 6 per cent. other insects.

- 134 - **Citrus ichangensis, a Promising New Hardy Species of Citrus**  
**S. W. China and Assam.** — SWINGLE, W. T. in *The Journal of Agricultural Research*,  
 Vol. 1, No. 1, pp. 1-14, + figs. 1-7 and 1 plate. Washington, October 10, 1913.

The Ichang lemon (*Citrus ichangensis*) was first collected in south China in 1888 by Henry; it was found again in 1903 by Wilson. Its occurrence in a wild state farther north and at higher altitudes than any other evergreen citrus suggests great possibilities in breeding cold-resistant citrus fruits. The size of its seeds makes it probable that it will produce vigorous seedlings suitable for stocks for other citrus fruits, while the popularity of its fruit and the high prices it commands at Hankow, suggest that it will be a valuable addition to our list of citrus fruits.

It is distinguished from other members of the genus by its huge seeds, its long, slender leaves, with their very large broadly-winged petioles often exceeding the blade in area. The writer gives a botanical description of the plant, illustrated by diagrams and plates, and its distribution in China.

- 135 - **The Pubescent-Fruited Species of Prunus of the South-Western States**  
 — MASON, S. C. in *The Journal of Agricultural Research*, Vol. 1, No. 2, pp. 1-12,  
 + figs. 8 + plates 8. — Washington, November 1913.

The writer describes seven species of *Prunus* indigenous to the southwestern States, which show closer affinities with some of the Asiatic species than with the wild plums of the country. Their adaptation to fluctuations of heat and cold, severe drought and considerable alkalinity of soil suggests possibilities to the fruit grower of adaptable stocks for arid regions and wider scope for the plant breeder.

Contrary to former belief, these species can be divided into small groups of quite diverse character and affinities.

Genus *Prunus*.Subgenus *Empleciogradus*.

Four species: *Prunus fasciculata* Gray, *P. minutiflora* Engelm.,  
*P. microphylla* Hems., and *P. Havardii* (Wight), n. comb.

Subgenus *Euprunus*.Section *Piloprunus* n. sect.

One species: *Prunus tesana* Dietr.

Section *Penarmeniaca* n. sect.

Two species: *Prunus Andersonii* Gray and *P. eriogyna* n. sp.

**A New Graft-Hybrid.** — DANIEL, L. in *Comptes-Rendus de l'Académie des Sciences*,  
 l. 157, No. 21, pp. 995-997. Paris, November 24, 1913.

The roots of an old pear tree (on quince) gave rise to a sucker in 1912 developed into an individual exhibiting characters, some of which intermediate between the two parents while others reproduced those of parent only but in an intensified degree. The case is the more remarkable as the graft-hybrid did not arise at the point of union of the stock and and that another sucker situated nearer to the point of union developed pure quince.

**An Economic Study of Acacias.** — SHINN, C. H. in *U. S. Department of Agriculture, Division of Publications, Bulletin* No. 9, pp. 1-38 + 11 plates. Washington, December 5, 1913.

The writer gives a detailed account of the various species of *Acacia* growing in America, pointing out their suitability for timber, commercial distillation of bark, tannin and gums, as shade trees, for reclaiming and waste sand, and for fodder. He also gives notes on their propagation and management.

## LIVE STOCK AND BREEDING.

**Rinderpest: Further Investigations on Questions Connected with the Economical Production of Antiserum.** — HOLMES, J. D. E. (Imperial Bacteriologist, Muktesar) in *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No. 2, pp. 33-80. Calcutta, November 1913.

The production of rinderpest antiserum was previously attended with considerable cost, as the virulent blood used for immunising and hyperimmunising the subjects preparatory to drawing off the antiserum, was obtained from an animal at the height of the malady to which it usually succumbed.

The substitution of buffaloes for hill bulls as virus producers effected a saving in economy, as the former will survive an attack of rinderpest and not produce virulent blood while suffering from the malady, but also antiserum when recovered. The writer experimented with hill bulls, which were inoculated with virus and received at the same time a protective dose of

serum, thus contracting the disease in a very mild form. The virulent serum from these animals was then used for hyperimmunising hill cattle, with the result that the serum subsequently produced proved almost as potent when virus was used which had been taken from hill cattle at the height of an unattenuated attack.

In a second set of experiments the writer contrasted the potency of serum obtained after a natural recovery or an immunising reaction alone, with the potency of serum from hyperimmunised cattle, and found that the two were very nearly equal. He also tested the potency of the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> bleedings after hyperimmunisation, and showed that the potency of the serum from hill bulls and buffaloes did not remain up to standard after the 3<sup>rd</sup> bleeding, while that from the plains cattle fell below after the 2<sup>nd</sup> bleeding, so that the practice of drawing blood 6 to 12 times from a hyperimmunised animal should be discontinued. Finally, a set of experiments was carried out to determine the minimum dose of virus required to hyperimmunise the bulls; it was found that the usual dose of 10-15 cc. per lb. of body-weight could be reduced to 2.5 cc. per lb. of body-weight for plains cattle and to 3 cc. per lb. of body-weight for hill cattle or buffaloes without decreasing the potency of the serum obtained subsequently, and further that animals will continue to produce serum of the same value if infected, even though the volume of virus injected each time remain the same.

- 139 - **Experimental Rachitis in Young Animals, the Offspring of Parents Deprived of the Thyroid Gland.** — CLAUDE, H. and ROUILLARD, J. in *Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, Vol. 75, No. 37, pp. 643. Paris, December 26, 1913.

The writers removed the thyroid gland from a male and a female rabbit shortly before pairing them, in order to test the effect of thyroectomy on the growth of the bones in the offspring. The female dropped eight normally developed rabbits and suckled them for forty days. During the first three weeks the young rabbits grew normally, then four of them died, but their skeletons did not show any apparent deformity. The remaining animals developed well up to the age of about six weeks, when they ceased to grow, their weight remaining stationary; they appeared depressed and sleepy, showing weakness in the limbs and at last impaired digestion, and three of them died between the ages of 7 and 13 weeks. Their skins, like those of the first four that died, did not present any pathological appearance. Their live weight was between one-half and one-third that of the control animals. The fourth rabbit survived and subsequent development was normal.

The post mortem examination of the three animals revealed important lesions of the skeleton: all three presented very marked deformities of the thorax, the front of which was flattened; the breast-bone was curved and the backbone also. At the articulations of the ribs there were spindle-shaped or irregular nodosities, and the radial, cubital and tibial epiphyses showed increase of volume with very marked lengthening of the connecting cartilage, increase of the chondroid stratum and excessive vascularization. The short and flat bones contained very much marrow. In all

animals the pelvis was much narrowed and in one of them the incipient curvatures.

On examining sections of the chondro-costal articulations under the microscope, alterations quite comparable to those occurring in human rachitis observed and are described by the writer in his paper.

A second litter from the same parents seemed normal at first, but then died of insufficient development and died young, but the lesions of the bones were not so characteristic of rachitis.

The writers draw from these observations the conclusion that the rabbits had suffered from typical rachitis and, as the gestation and suckling periods had been normal and the animals had been kept under the most favorable conditions, while the digestive troubles had commenced only shortly before death, they attribute it to the thyroidectomy practised on parent rabbits.

It is consequently possible that a hereditary thyroid insufficiency may cause of rachitis.

**Metabolism during Pregnancy and the Lactation Period.** - DIENES, LUDWIG. *Biochemische Zeitschrift*, Vol. 55, Part 1-2, pp. 124-133. Berlin, September 12, 1913.

A communication of the results of experiments on the metabolism takes place in a bitch during pregnancy and before and after the lactation period. The metabolism appears to decrease slightly in the middle of the first half of pregnancy, while it increases considerably during the second half of time. During lactation, it is much more active than during pregnancy. At the beginning of the lactation period, the mother and young expend the same amount of energy per surface unit. With the cessation of lactation, the expenditure of energy rapidly decreases again.

**The Digestion of Crude Fibre by Sheep and Pigs.** - ANGERLING, BRETSCH, KÖSCHE and ARNDT in *Die landwirtschaftlichen Versuchstationen*, Vol. 83, Part III-IV, p. 181-210. Berlin, December 23, 1913.

The authors experimented upon two wethers and two improved Meishan pigs, with "digested" straw, young grass and wheat chaff. The "digested" straw was prepared by boiling straw under pressure in an aqueous liquid; it thus contains a less lignified crude fibre. In the wheat chaff the crude fibre was much lignified and permeated by encrusting matter. In this latter respect grass occupied an intermediate position between "digested" straw and chaff.

The arrangement of the experiment and the rations fed daily per head during the experiment are shown in Table I.

The additions of "digested" straw, grass and chaff to the basal ration were made in small quantities at the beginning of each period and only towards the end in the full quantity. This was done in order to accustom the animals gradually to the new food. Each period lasted 11 days and commenced after a preparatory period of several days. Samples of the dung from the animals were collected daily, and examined at the end of the period. The examination of the food and the dung was carried out according to



TABLE I.

Designation of feeding period	Wethers	Pigs
1. Basal ration . . .	700 grams meadow hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt.	1000 gms. barley groats + gms. fish meal + 10 gms.
2. "Digested" straw.	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 600 gms. "digested" straw.	1000 gms. barley groats + gms. fish meal + 10 gms. + up to 600 gms. "digested" straw.
3. Grass * . . . . .	350 gms. hay + 50 gms. gluten + 125 gms. starch + 10 gms. salt + up to 1500 gms. grass.	500 gms. barley groats + gms. fish meal + up to 1000 gms. grass.
4. Wheat chaff . . .	700 gms. hay + 100 gms. gluten + 250 gms. starch + 10 gms. salt + up to 250 gms. wheat chaff.	1000 gms. barley groats + gms. fish meal + 10 gms. + up to 250 gms. wheat chaff.

\* In this period only half the basal ration was fed, as it was feared that without this grass the pigs would not consume the grass; but this fear was found to be groundless.

TABLE II.

	Dry matter	Organic matter	Crude protein	Nitrogen free extract	Fat	Crude fibre	Pure protein	%
	%	%	%	%	%	%	%	%
<i>"Digested" straw.</i>								
Wethers . .	72.65	73.19	—	72.23	—	77.27	—	55 <sup>1</sup>
Pigs . . .	101.22	88.85	—	63.75	—	94.81	—	—
<i>Grass.</i>								
Wethers . .	65.29	69.77	76.85	67.29	66.93	69.49	74.05	37 <sup>6</sup>
Pigs . . .	49.58	51.86	52.05	52.07	84.35	39.39	47.32	35 <sup>8</sup>
<i>Wheat chaff.</i>								
Wethers . .	40.33	46.93	55.56	51.54	—	30.34	47.67	19 <sup>8</sup>
Pigs . . .	20.53	22.95	—	27.86	—	—	—	12 <sup>8</sup>

methods adopted at the Mockern and Hohenheim (Germany) Experiment Stations.

The average digestion coefficients for the three fodders experimented are given in Table II.

It will be seen from the above that the pigs digested the crude fibre of grass was not or only slightly lignified better than the sheep, while the sheep were able to utilize better the crude fibre more or less permeated with stinging matter. The better utilization of the crude fibre of "digested" grass by pigs depends partly upon the fact that with the sheep some of the crude fibre of the basal ration escapes digestion. It can therefore be stated that pigs are superior to ruminants in their power of digesting pure cellulose.

The pigs digested 39.39 per cent. of the cellulose of grass, but they were unable to attack that of wheat chaff, the reason of this difference being that the incrustations are less readily dissolved in the alimentary canal of pigs than in that of ruminants. The superiority of ruminants as regards power of dissolving cellulose in young grass and in wheat chaff is very probably due to the finer division obtained by better mastication and more intense fermentation of the food in the digestive organs.

Summarizing the results, it may be said that pigs are as capable as ruminants of dissolving pure crude fibre or that containing but little encrusting matter, but lose this power in proportion as the encrustation and lignification of the crude fibre increases.

**The Influence of Butter-fat on Growth.**—OSBORNE, T. B. and MENDEL, L. B. (Connecticut Agr. Exp. Station and Yale University) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 423-437. Baltimore, December 1913.

In previous papers (1) the writers showed that the substitution of unsalted butter for part of the lard in a "protein-free milk" food (consisting of protein, starch, "protein-free milk" or its equivalent, and lard) would enable rats to grow normally even if previous malnutrition had arrested development. In the present investigations pure butter-fat was substituted for butter in order to determine whether it contained the active principle.

The pure butter-fat was isolated from the butter by centrifuging the butter at 45° C. for about an hour. At the end of that time the clear melted fat forming the upper layer in the flask was quite free from all impurities, the aqueous solution containing lactose, etc., and the solid matter present in the butter having collected below. The fat was pipetted off and introduced into the daily rations which were made up as follows:

Protein . . . . .	18 per cent.
Starch . . . . .	26 " "
" Protein-free milk " . . . . .	28 " "
Lard . . . . .	10 " "
Butter-fat . . . . .	18 " "

(1) See No. 1171, B. Oct. 1913.

In every case normal growth was obtained on this diet and rats' weights were decreasing on a "protein-free milk" food immediately covered.

As the pure butter fat contains no trace of nitrogen, phosphorus, ash, its efficiency in promoting growth cannot be attributed to the presence of nitrogen or phosphorus containing bodies such as lecithin, phosphatides, etc., nor to inorganic salts. Investigations as to the essential difference between butter-fat and lard are being pursued and include the comparison study of a number of other fats.

143 - **The Nutritive Value of Potato Distiller's Slop and of the Substances from which it is Made.** — VÖLZ, ZUNTZ, VON DER HEIDE and KLEIN in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 681-832. Berlin, 1913.

There being no reliable data on the nutritive value of potato distiller's slop in comparison to the substances from which it is derived, the writers started an exhaustive investigation into the subject. Already some experiments have been carried out, some being on the digestibility of the food in the digestive organs and the others on the exchanges of gas taking place with this feed. The animals chosen for former experiments were three wethers, and for the latter a 4-year-old sheep.

For the better carrying out of the experiments the writers prepared a mash of potatoes and dried slop. The materials for the slop consisted of 2420 lbs. of potatoes (Walthmann variety) containing 18.5 per cent. of starch, 110 lbs. of malt and 0.66 lb. yeast. The mash was allowed to ferment to 10° Balling. The other food was prepared by cooking together to a pulp 2420 lbs. of potatoes (Walthmann) containing 18.5 per cent. of starch, 110 lbs. malt and 0.66 lb. yeast, and drying.

The loss of energy that the materials underwent by being transformed into slop averaged 68.8 per cent., so that the slop contained 31.2 per cent. of the calories of the original materials. On analysis it was found that by the preparation of the slop, about one-third of the amides of the original matter had been transformed into yeast protein.

#### I. Experiments on Sheep.

The experiments on the sheep were arranged as shown in Table I.

By feeding potato starch (as a substitute for the loss of energy caused by fermentation) with slop, the writers wished to ascertain the changes brought about by the preparation of the slop, especially in the nitrogenous nutritive matter, act upon the digestion. The only object of the experiments was to determine their nutritive value as a concentrated food. In order to determine which ration caused the greatest feeling of thirst, an account was kept of the quantities of water taken and lost. The dung of the animals was always examined fresh. In order to corroborate the results of the experiments on wethers, the writers undertook some on rats also. All the experiments were preceded by a preparatory period of 6 or 7 days.

The results of the experiments gave the following the average digestible values in the three basal ration periods:

Organic matter . . . . .	60 %	Crude fibre . . . . .	67 %
Crude protein . . . . .	56 "	Nitrogen-free extract . . . . .	59 "
Crude fat . . . . .	33 "	Calories . . . . .	56 "

TABLE I.

Period	Duration of Period, Days	Average consumption of food per day
1. Basal ration . . . . .	8	700 grams hay.
2. Slop + starch . . . . .	6	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
1. Basal ration . . . . .	8	700 gms. hay.
2. Potatoes + malt + yeast . .	8	700 gms. hay + 250 (potatoes + malt + hay).
3. Slop + starch . . . . .	8	700 gms. hay + 75.46 gms. slop + 198.4 gms. potato starch.
4. Slop. . . . .	8	700 gms. hay + 250 gms. slop.
1. Basal ration . . . . .	7	700 gms. hay.
2. Potatoes + malt + yeast . .	8	700 gms. hay + 250 gms. (pota- toes + malt + yeast).
3. Slop. . . . .	8	700 gms. hay + 250 gms. slop.
4. Lentils . . . . .	8	700 gms. hay + 250 gms. lentils

the physiological utilization value of hay was 45 per cent. and the ration of the dung showed approximately nitrogen equilibrium. Digestive values agree with those previously obtained by the writers. Daily amount of water taken was 1.94 quarts per head and stood to the matter consumed as 3.4 : 1.

In the two potato + malt + yeast periods compared with the basal ration it showed a great depression of the percentages of digestion of crude and crude protein. These were respectively 24 per cent. and 14 per cent., and were very probably a consequence of the very low protein and high soluble carbohydrate content of the ration.

In the mixture: potatoes + malt + yeast, the following digestion were determined:

Organic matter . . . . .	69 %	Nitrogen-free org. matter . . . . .	74 %
Crude protein . . . . .	20 %	Calories . . . . .	67 %

The physiological utilization value of the mixture was 65 per cent.; assimilation of nitrogen by 1000 lbs. live-weight was 26.54 gms. per day. Amount of water taken was 2.49 quarts per head and day and stood to assimilation of dry matter as 3.2 : 1.

The two slop + starch periods showed in comparison to the hay ration periods a lower digestion of the crude protein and crude fibre of the ration: 8.9 and 7.5 per cent. respectively. It follows that the nutritive substances were deeply modified by the preparation of the ration. The digestibility of the crude protein and crude fibre was, however, better here than in the potato + malt + yeast periods, which the writers attribute to the former ration being a better medium for the intestinal bacteria than the latter.

The digestibility of the mixture slop + starch was the following:

Organic matter . . . . .	86 %	Nitrogen-free org. matter . . .	94
Crude protein . . . . .	27 "	Calories . . . . .	83

The physiological utilization value of the mixture slop + starch was 70 per cent., and was 5 per cent. higher than that of the mixture potato + malt + yeast. The nitrogen assimilation was 35.81 gms. per 1000 lbs. live-weight. The water taken up was 2.29 quarts per head and per day and stood in the ratio of 3 : 1 to the consumption of dry matter.

The two slop periods gave the following digestion values:

Organic matter . . . . .	84 %	Nitrogen-free organic matter . .	94
Crude protein . . . . .	61 "	Calories . . . . .	84

For the nitrogen-free extract a digestion value of 114 per cent. was found, which is to be attributed to the nitrogen-free extract of the hay being more digestible when fed with slop than when fed alone. This, according to the writers, is less to be attributed to a specific action of slop than to a better adaptation of the microflora in the alimentary tract consequent upon the preceding feeding with hay.

The physiological utilization of slop was 69 per cent., and the assimilation of nitrogen 29.45 gms. per 1000 lbs. live-weight. The water taken was 3.42 quarts per head and day and the ratio to the dry substance taken up was as 4.4 : 1.

The lentil period gave the following digestion values:

Organic matter . . . . .	85 %	Crude fibre . . . . .	51
Crude protein . . . . .	79 "	Nitrogen-free extract . . . . .	98
Crude fat . . . . .	63 "	Calories . . . . .	84

The physiological utilization value was 62 per cent. and the nitrogen assimilated was 20.13 gms. per 1000 lbs. live-weight per day. The water taken up was 2.91 quarts and the ratio to the dry matter as 3.8 : 1.

These digestion values agree nearly with those of beans.

From the digestion experiments on rats the conclusion may be drawn that the digestibility of the material for the preparation of slop is not inferior to the slop plus an isodynamic amount of potato starch to replace loss by fermentation. The digestion values for lentils obtained by experiment on rats were approximately the same as those obtained with sheep.

The writers draw from these experiments the following conclusions :

The slop causes a greater sense of thirst than the materials from which prepared; this is chiefly due to its high content of potash salts. It is, however, possible that slop contains specific thirst-exciting substances.

The addition of common salt as well as the dilution and neutralization of slop is not to be recommended. It should besides be fed warm rather than cold.

The nitrogenous nutritive matter of slop seems, notwithstanding its low protein content, to possess no higher nutritive effect than the nitrogenous foods rich in amides from which it is derived. From this it may be concluded that the amides of the feeds are to be included among the nitrogenous nutriment as well as proteins.

The digestibility of slop is considerably greater than has been hitherto generally accepted. Kellner set the digestibility of crude protein in slop at 61 per cent. and that of the organic matter at 58 per cent., while the experiments of the writers give the above values at 61 and 84 per cent. respectively.

If the slop and the material from which it is derived are calculated according to Kellner's values for starch and digestible crude protein, the value works out to 15.94 per cwt. for the material and to 7.14 per cwt. for the amount of slop made out of 1 cwt. of the same material. The value of the slop would thus be about one-third that of the material from which it was derived. But it has been shown that, chiefly through a low nitrogen content of the ration, only 20 per cent. of the crude protein and 74 per cent. of the nitrogen-free organic matter of the material are digested, with feeds richer in protein, 51 per cent. of the protein of potatoes and 90 per cent. of the nitrogen-free organic matter are digestible. If now other figures are introduced into the calculations instead of the former, the value of the material would be 28.1584 per cwt. instead of 15.94. In this case the value of the slop would only be about one-quarter of that of the material from which it was made. It is thus seen that the ratio of between the material and the resulting slop has a considerable range, and that it depends to a great extent upon the composition of the ration. The writers cannot endorse the generally accepted opinion that the starch content of a food under varying conditions of feeding corresponds to the nutritive value.

#### I. Experiments with a steer.

The experiments made with a steer were arranged as follows :

Period	Daily consumption of food
1. Basal ration . . . . .	17.6 lbs. of hay
2. Basal ration + malt + yeast . . . . .	15.4 lbs. of hay + 5.5 (potatoes + malt + yeast).
3. Basal ration + starch . . . . .	15.4 lbs. of hay + 754.6 gms. slop + 1.984 gms. starch
4. Basal ration + malt + yeast + starch . . . . .	15.4 lbs. of hay + 5.34 lbs. of slop.

Each experiment lasted 16 days and was commenced after a preparatory period of 8 days. On the first and last day of each period the animal was kept in a Regnault Reiset's respiratory calorimeter. The most important results of these experiments, which are to be continued, may be summarized as follows: In the utilization of the rations no great differences were observed between the steer and the sheep. The nutritive material was digested somewhat better by the steer, while the additions to the hay were better utilized by the sheep. From the respiratory experiments it was seen that the most insignificant changes in the composition of the food influenced the fermentation process in the paunch and consequently the results of the feeding. Also the quantity of the aromatic compounds that passed into the urine varied with the composition of the food. The writer concludes from this that the starch value of a food calculated according to Kellner can differ very much from the one found by a respiratory experiment. The quantity of carbonic acid evolved by the fermentation process in the intestines amounted often to upwards of one-third of the carbonic acid emitted by the animal, from which it may be inferred that the determination of the quantity of carbonic acid alone is no test of the metabolism of ruminants.

144 — **Colour Inheritance in the Horse** (1). — WENTWORTH, E. N. (*Ames, Iowa Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, No. 1-2, pp. 11, Berlin, November 1913).

Microscopic examination and simple chemical tests show that two pigments are concerned in the coat colour of horses: 1) red pigment distinct from the yellow ground pigment present in all coloured horses and 2) black pigment, which masks the red colour. Quantitative differences occur with regard to the amount of pigment present, thus producing the dilute colours.

The writer suggests a new scheme of factors (see below) which differs from that of most modern investigators in not attempting to arrange the colours as an epistatic and hypostatic series of simple factors.

- C = red pigment or yellow basic pigment.
- H = black pigment.
- B = a restriction factor, producing bay in presence of H.
- G = grey pattern.
- R = roan pattern.
- D = dappling factor.
- S = white blaze on forehead and white legs.
- P = piebald and skewbald markings.
- M = creamy yellow mane and tail.
- I = dilution factor.

According to this scheme: *Chestnut* should contain C and might in some cases also contain B and M; *black* contains CH and may have D in some cases; *mouse* contains CHI, with the possible addition of D; *dun* contains

(1) See No. 1355, B. Dec. 1913.

BI, or CMI; *bay* contains CHB; *brown* contains CHBD; *gray* contains D or possibly CGD; *blue roan* contains CHR; and *red roan* contains or CHBR.

The writer discusses the scheme in reference to all available records viz: Sturtevant's, Wilson's and Anderson's tables, together with his personal observations.

— **A Cross Involving Four Pairs of Mendelian Characters in Mice.** — LITTLE, C. and PHILLIPS, J. C. in *The American Naturalist*, Vol. XI, VII, No. 564, pp. 760-762. Lancaster, Pa., December 1913.

The writers state that the experiments recorded in the above article planned as a control to more detailed investigations being carried at the Bussey Institution. The four pairs of characters in question were follows:

<i>A</i> = agouti,	<i>a</i> = non agouti.
<i>B</i> = black,	<i>b</i> = no black (brown).
<i>D</i> = density,	<i>d</i> = diluteness.
<i>P</i> = dark eye,	<i>p</i> = pink eye.

A wild grey mouse of the gametic formula  $ABDP$  was crossed with a key-eyed dilute brown mouse of the formula  $abd p$ . The  $F_1$  generation resembled the wild parent and were mated *inter se*, producing 1180  $F_2$  individuals. These split up into 16 different groups and gave numbers in accord with the expected.

Both when each allelomorphic pair is considered separately and when results are taken as a whole, animals possessing dominant characters show a slight excess over the expected numbers, but this is not sufficient to support any theory of coupling, and may be due to selective elimination, as the observations were made when the mice were already four weeks old.

— **Heredity and Regeneration of the Testis in Birds.** — BOND, C. J. in *Journal of Genetics*, Vol. 3, No. 2, pp. 131-139, plates IV and V, figs. 1-9. Cambridge, September 1913.

The writer performed orchectomy on fowls and pigeons and observed the regeneration of the gamete-bearing tissue. Experiments were then carried out to ascertain whether the gametes which are formed in this regenerated tissue resemble in their hereditary characters the gametes which are formed by the original gland before removal. In these experiments birds of known genetic composition were used and the cocks were mated with the same females throughout the experiments.

The offspring of a Brown Leghorn cockerel were of the same type before and after castration. Those of a male Blue Chequer Fantail pigeon were identical in plumage, but among the young hatched before castration none showed any feathers on the toes, whereas out of the 17 hatched after regeneration of the testis 4 showed signs of feathered tarsi. A male Black-and-White Fantail pigeon mated with an Almond-and-White sister produced 10 young after castration, 10 young, of which only one was white. After castration and regeneration of the testes the same pair produced 34 young pigeons of which 7 were white.



It would therefore appear that the Leghorn cockerel was homozygous in respect of colour, that is to say that only one kind of gamete was being produced before castration. There is no reason then to expect that the increased production of spermatozoa during regeneration of the testes would be due to the production of gametes of a different kind. On the other hand it is likely that in a sex gland where gametes of different factorial composition are being produced, the temporarily arrested and subsequently increased division might result in a different rate or order of production of the different kinds of gametes being formed in that particular organ.

The writer suggests further experiments on the removal and regeneration of the sexual glands of fowls of both sexes which are known to be producing gametes of two kinds only. With confirmation of his results, he considers that a detailed study of the changes in cell division during regeneration of the sperm mother-cells may throw much light on certain results in breeding which seem to be inconsistent with Mendelian expectation. Many apparent anomalies may owe their existence to some change in the rate of production of gametes of different kinds in that particular sex gland.

147 - On the Zygotic Constitution of Dominant and Recessive Whites in Silkworm, *Bombyx mori* L. — TOYAMA, K. and MORT, S. in *Zeitschrift für allgemeine Abstammungs- und Vererbungslehre*, Vol. 10, No. 3, pp. 232-247. Berlin, 1912.

Earlier researches of one of the writers (1) led him to conclude that there must be two kinds of white silkworms, one dominant and the other recessive to coloured breeds. In order to investigate the matter further a cross was made in the spring of 1911 between females of the Japanese voltine white (Yamato-nishiki) and males of the European white (sine line) both of them being white cocoons sometimes faintly shaded with green yellow, and breeding true to type. Nine matings gave 2344 cocoons, white but showing a variation of shading up to light greenish yellow like the parents. This  $F_1$  generation was divided into nine classes according to shading, and moths derived from each class were paired *inter se*. The generation consisted of 17661 individuals, and in every class white: yellows appeared in the ratio of 13 white to 3 yellow. These results indicate that two pairs of Mendelian characters are involved, the presence and absence of a colour-inhibiting factor, and  $Yy$  presence and absence of yellow colour, and that the parents were  $SSyy$  and  $ssyy$  respectively.

The writers point out that with this scheme five different kinds of individuals may be obtained, indistinguishable by their outward appearance, viz.  $SSYY$ ,  $SSyy$ ,  $ssyy$ ,  $SSYy$ ,  $Ssyy$ , and that this may account for the rather conflicting results previously obtained in certain silkworm crosses.

(1) TOYAMA, K. On the varying dominance of certain white breeds of the silkworm *Bombyx mori* L. — *Zeitschr. f. induktive Abst. u. Vererbungslehre*, Vol. 7, 1912.

1D. On certain characteristics of the silkworm which are apparently non-Mendelian. — *Biolog. Centralblatt*, Vol. 32, 1912.

**Non Disjunction of the Sex Chromosomes of *Drosophila*.** — BRIDGES, C. B. (Columbia University), in *The Journal of Experimental Zoology*, Vol. 5, No. 4, pp.587-605. Philadelphia, November 1913.

During the course of his breeding experiments on *Drosophila*, the writer lately met with a certain kind of exception to the ordinary rules of limited inheritance, which led him to conclude that with some female mutants non-disjunction occurred in a certain percentage of the maturation, i. e. ova were formed which contained two sex-chromosomes instead of the normal one, while other corresponding ova contained no sex-chromosome. He discusses the application of partial sex-limited inheritance to these cases and shows that the hypothesis does not fit his results.

**Comparative Digestion Experiments on Equidae.** — FRANK, O. in *Kühn-Archiv*, Vol. 3, Heft - vol. 2, pp. 363-396. Berlin, 1913.

The writer conducted a series of digestion experiments, at the beginning of the year 1913, at the Agricultural Institute of the University of Halle a. H., with the object of ascertaining whether a different power of digesting food existed in horses, asses and their hybrids. The animals included were a gelding and a mare, a jack and a female ass, two mules (a gelding and a female) and two hinnies (a gelding and a female).

The mare was of the Mongolian breed, while the gelding possessed the Belgian blood. The writer purposely selected two distant breeds of horses in order to ascertain incidentally how the extreme country and blood-bred breeds behaved as to the utilization of food. The other groups could be considered as nearly uniform.

In order to simplify matters, the food used consisted only of hay and oats, and they were fed mixed. Their chemical composition was the following:

	Dry matter	Nitrogen	Crude protein	Crude fat	Crude fibre	Nitrogen free extract	Ash
	%	%	%	%	%	%	%
.....	84.28	1.20	7.50	1.49	28.76	40.24	6.29
.....	86.255	2.015	12.59	3.535	10.805	56.675	2.65

The daily rations at first were 10 lbs. hay and 10 lbs. oats per 1000 lbs. live weight. It soon appeared, however, that this was too much and only so much was given to each animal as it could eat. Water was provided *ad lib*. The experiment lasted 10 days and was preceded by a preparatory period of 10 days. During the 10 days the excrement of each of the animals was collected and one-thousandth of it weighed and examined. The animals were kept in a stable which allowed of a perfect collection of the excrement.

ment. In the determination of the nutritive matter the following methods were followed :

Dry matter : by difference in the desiccator.

Ash : by ignition.

Nitrogen and crude protein : by Kjeldahl's method.

Crude fat : by Soxhlet's

Crude fibre : by Holdefeiss'

Nitrogen-free extract : Indirectly by difference.

The digestion coefficients for the several animals are given in the following table.

	Dry matter	Crude protein	Crude fat	Crude fibre	Ash	Nitrogen-free extract
	%	%	%	%	%	%
Jack . . . . .	63.04	65.01	39.35	39.56	34.32	76.1
She ass . . . . .	67.53	66.41	49.09	49.05	20.42	80.4
Hinny gelding . . . . .	71.72	73.50	51.12	46.53	37.90	85.5
Hinny mare . . . . .	66.06	66.57	61.79	46.16	32.20	77.4
Gelding . . . . .	62.32	71.08	34.51	37.82	28.81	74.5
Mare . . . . .	67.10	70.73	42.39	45.46	31.04	78.7
Mule gelding . . . . .	64.04	66.47	39.20	43.48	39.71	75.2
Mule mare . . . . .	63.00	58.87	39.78	49.06	35.53	76.2

From the above it appears that there are notable differences in the utilization of food among the various animals. Among the horses, the mare, belonging to a thrifty country breed, digested the food, with the exception of crude protein, better than the gelding belonging to an exacting breed. The latter was distinguished by a high utilization of crude protein, in which it was surpassed only by the hinny gelding. In the utilization of crude fat and crude fibre the mules and hinnies were superior to the gelding and inferior to the mare.

The experiment justified the conclusion that thrifty breeds of horses compete in thriftiness with mules. The statement of Sanson that mules are less exacting than horses, because they can utilize raw protein better, is not borne out by these experiments.

The writer has also calculated how much food each animal took per unit of surface, and found that the opinion that the smaller the animal the greater the energy it requires to keep up its vital processes, was not confirmed.

**- The South Oldenburg Horse and the Economic Conditions of its District.**

BURMESTER, HARALD in *Kühn-Archiv*, Vol. 3, Half — Vol. 2, pp. 397-505. Berlin, 1913.

This work contains exhaustive data on the soil, water, and climate of the Oldenburg, as well as on the density of population, utilization of oil, and conditions of proprietorship and of means of communication. It treats then of the general development of horse breeding from its commencement down to the present time and of the ancestry of the breed itself. In the last section of the work the writer discusses the development of the breed with the aid of measurements carried out on 615 living animals.

**- Colour in Shorthorn Cattle** (1). — WENTWORTH, E. N. (Ames, Iowa) in *The American Breeders' Magazine*, Vol. IV, No. 4, pp. 202-208, Washington, December 1913.

The hypothesis that roan cattle are the simple heterozygotes of a red and white cross has been shown to be only very approximately verified by the breeding records of Shorthorns. The writer suggests that two Mendelian factors are involved instead of one, *viz.* *Rr*, presence and absence of pigmentation, and *Pp*, presence and absence of roan "pattern" or admixture of hairs.

The records of the Iowa State College Herd show that individuals which must have been pure homozygous reds, *RRpp*, and homozygous whites, *rrPP*, when mated together gave an  $F_1$  generation all roan and an  $F_2$  generation made up of:

36 roan, 11 red, 17 white (9 : 3 : 4 ratio);

the roans, which from their records were apparently of the two types *Rrpp* and *RrPP*, gave the following results:

<i>RRpp</i>	bred	<i>inter se</i>	gave	10 roan	4 red
<i>RrPP</i>	»	»	»	8 »	2 white
<i>RRpp</i>	×	<i>RrPP</i>	»	8 roans	
<i>RRpp</i>	×	<i>Rrpp</i>	»	3 »	1 red
<i>RrPP</i>	×	»	»	4 »	2 white.

The writer then discusses the white markings found on both red and white animals, and considers that these are quite distinct from the roan pattern.

According to the above scheme of inheritance, and if reds and red-and-whites are grouped together in one class, then reds mated to reds can only produce roans, and whites to whites can only produce whites.

The writer has gathered breeding records together from various sources and tabulates them, but the latter show serious discrepancies with the expected results. On following up a large number of the discordant cases, however, he has been able to prove that they were wrongly classed in the first place, and it therefore seems likely that the other discordant cases may be due to similar errors.

(1) See No. 525, B, March 1912.

152 - The Influence of Feeds on the Quantity and Fat and Bacterial Content of Milk. — LUCAS, J. E. in *L'Industrie Laitière*, Year 38, No. 47, pp. 752-761, November 23, 1913.

The writer conducted a feeding experiment on 21 cows of equal yield, with the object of determining by comparison the influence of wet and dry feeding on the quantity, fat content and bacteria of the milk. Earthnut cake, wet and dry, and mangolds, whole and sliced, were used. The daily ration, which was the same for all the animals, consisted of 99 lbs. mangolds, 6.6 lbs. chaff, 11 lbs. lucerne hay, 3.3 lbs. maize gluten, 3.3 lbs. earthnut cake and 3.3 lbs. wheat bran.

The experiment was divided into a preparatory and a transition period, then the experiment proper and lastly a closing period, and the cows were divided into three groups.

The cake and mangolds were fed as follows :

Preparatory period : 14 days .....	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">Group I</div> <div style="display: inline-block; vertical-align: middle;">» II</div> <div style="display: inline-block; vertical-align: middle;">» III</div> </div>	wet cake, sliced mangolds
Transition period : 8 days .....	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">Group I : wet cake, sliced mangolds</div> <div style="display: inline-block; vertical-align: middle;">» II : dry » whole »</div> <div style="display: inline-block; vertical-align: middle;">» III : dry » sliced »</div> </div>	
Experiment proper : 30 days .....	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">Group I : wet cake, sliced mangolds</div> <div style="display: inline-block; vertical-align: middle;">» II : dry » whole »</div> <div style="display: inline-block; vertical-align: middle;">» III : dry » sliced »</div> </div>	
Closing period : 14 days .....	<div style="display: inline-block; vertical-align: middle;"> <div style="display: inline-block; vertical-align: middle;">Group I</div> <div style="display: inline-block; vertical-align: middle;">» II</div> <div style="display: inline-block; vertical-align: middle;">» III</div> </div>	wet cake, sliced mangolds

The feeds were weighed daily, separately for each group and at the same time. Immediately after each milking, which also was done at the same time, the milk and fat yield of each cow were determined. Seven times during the whole experiment a sample of milk was taken in the morning and in the evening under aseptic conditions, from each group, examined as to its content in bacteria. The cows averaged 1100 lbs. weight and were all kept in the same stable.

The result was that the performance of the three groups did not differ sensibly from each other in milk yield and fat content during the experiment.

In the bacterial content no striking difference was observed in the milk of the three groups. It seemed, however, that the moist feeds were somewhat more favourable to the development of the milk flora than dry feeds.

The writer concludes that with the exception of a slightly higher yield from the groups fed on whole mangolds, feeding wet or dry had no influence on the quantity of the milk and on its fat or bacterial content.

- **The Zackel Sheep in Bosnia and Herzegovina** (1). — **MEHMEDRASIC, MAHMUT** in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, Part 2, pp. 307-330. Vienna, November 29, 1913.

This paper is a very exhaustive study on the breeding of Zackel sheep in the districts of Gacko, Stolac and Travnik in Bosnia-Herzegovina. It contains data on the natural conditions of production of the land, on the conformation of the body and on the skull, on the fleece and on the yield of these sheep, on the manner of breeding them and utilizing them (wool, milk, flesh) and also on the economic importance of the flocks. As an appendix to the paper the writer gives in six tables the measurements of the skeleton and of the wool made on 60 animals. He concludes that there are three breeds of Zackel sheep, the chief exterior distinctions of which are the weight of the horns and the length of the wool. The heaviest horns and the longest wool are found in the Vlasic (Travnik) sheep and the lightest horns and shortest wool in the Stolac flocks, while the Gacko sheep are intermediate. For the improvement of the breeds he recommends selection for pure breeding.

- **Pig Fattening Experiments with Manioc Roots** (2). — **FRATEUR, J. L.** and **MOLBAUT, A.** in *Laiterie et Elevage*, Year 8, No 11, pp. 81-88. Louvain, November 1913.

The writers carried out for the Ministry of the Colonies two fattening experiments with manioc in order to test its value as food for pigs.

Experiment I was made on a lot of 5 pigs and Experiment II on two lots of 10 pigs each. The animals of lot 1 were of the local breed. Those of lot 2 were crosses of the local breed and Yorkshires. Lot 3 consisted of pigs of the improved local breed. In lot 1 the pigs were full grown and in the other two they were still growing. The rations for lot 1 were composed of manioc and pollards in equal quantities and some mangold slices and meat meal. Lots 2 and 3 were fed manioc and pollards in equal parts and skimmed milk. Much manioc and pollard mixture was fed as the animals could eat. The skimmed milk was given throughout the whole experiment in nearly the same quantity. The animals were fed morning and evening, and the food of each lot was weighed daily.

The Experiment on lot 1 lasted 77 days and on lots 2 and 3, 58 days. The preliminary periods were 28 and 19 days respectively. As the pigs of the last two lots accustomed themselves from the beginning to the new food, the preparatory period was shortened. The pigs of lot 1 up to the 14th day of the experiment were fed manioc as raw meal mixed with the other food, but as their appetite soon diminished the cassava roots were steeped in water for 24 hours and then boiled and mashed to a pulp before being fed. After this change the appetite of this lot kept normal and only diminished gradually towards the close of the experiment. During the experiment they received an average of 4.44 lbs. manioc, 4.44 lbs. pollards, 3.52 lbs. mangolds and 0.40 lb. meat meal.

(1) See Original Article, p. 680, *B.* May 1913.

(2) See No. 1173, *B.* Oct. 1913.

(Ed.).

(Ed.).

Lots 2 and 3 were fed manioc reduced to pulp from the beginning; the appetite kept good all the time, only diminishing towards the end. Lot 2 were fed 3.25 lbs. of manioc, 3.25 lbs. of pollards 11 lbs. of skimmed milk per head per day and the pigs of lot 3, 2.70 lbs. of manioc, 2.70 lbs. of pollards and 11 lbs. of skimmed milk.

The results of the experiment were that all the animals were fattened and some very well. Their flesh was savoury and had good keeping qualities; the fat was white and firm. The daily increases in live weight per head were: in lot 1, 1.303 lbs., in lot 2, 1.478 lbs. and in lot 3, 1.374 lbs.

**155 - Reciprocal Crosses between Reeves' Pheasant and the Common Neck Pheasant Producing Unlike Hybrids.**— PHILLIPS, J. C. in *The American Naturalist*, Vol. XLVII, No. 563, pp. 701-704. Lancaster, Pa., November 1913.

In reciprocal crosses between *Syrnalicus reevesi* and *Phasianus versicolor*, two types of male hybrid were obtained according to the nature of the cross. The appearance of these two types is described.

**156 - Actinomyces in Carp.**— PLEHN, M. in *Allgemeine Fischerei-Zeitung*, Year 1913, No. 24, pp. 624-625. Munich, December 15, 1913.

According to the investigations of the writer, this disease, which was first observed in goldfish, and is due to an *Actinomyces*, also attacks carp.

In the latter case, it progresses very slowly and it is some years before the function of the affected organ is hindered. If the fish is but slightly infested, its health does not suffer. In dissecting, macroscopic changes are only visible when the fish is entirely infested by the fungus; the microscope, however, reveals the initial stages of the disease. The parasite usually occurs in the peritoneum, which, when the disease is far advanced, becomes inflamed and is seen to be thickened. This thickening is due to an abnormal deposit of fat in the peritoneum. Often a similar fat deposit is also found in the lobes of the liver, and in the membrane covering the kidneys and air-bladder. The accumulation of fat in an organ can prove so far as to make the fish quite dull and lethargic, and liable to die from the slightest injury. The fungus is probably taken up with vegetable food. The only known method of controlling this disease is the elimination from the breeding stock of all fish which have become abnormally fat upon a moderate diet. The consumption of fish affected by actinomyces is not attended with any danger to mankind.

## FARM ENGINEERING.

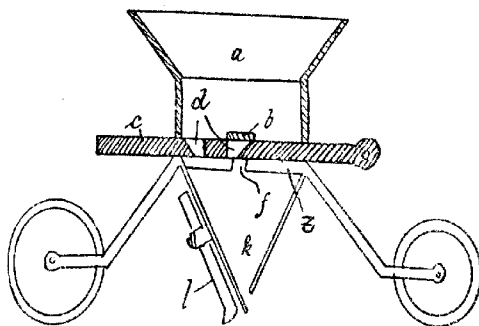
**157 - New Beet-Seed Dibbling Machine (German Patent No. 552 166).**— *Zeitung für Zuckerrübenbau*, Year 20, No. 24, p. 387. Berlin, December 31, 1913.

This beet-seed dibble consists of a frame mounted on wheels bearing a seed hopper (a) the bottom of which is formed by a plate (z) with an angled

(1) See No. 722, B. June 1913.

(Ed.)

(f) through which the seed falls. At a short distance above this aperture a block (b) is situated and between this block and the bottom of the hopper a distributing slide is driven backwards and forwards. In the slide there are two openings (d) so arranged that they alternately drop the seeds at certain intervals through a funnel (k) into the furrow opened by the adjustable share (l).



New beet-seed dibbling machine.

**Trials of Milking Machines in England (1913).** — *Mitteilungen des Verbandes landwirtschaftl. Maschinen Prüfungs-Anstalten*, Year 7, Part 4, pp. 129-153. Berlin, 1913.

In 1913 the Royal Agricultural Society of England organized a competition for milking machines in connection with the Show held at Bristol (1). Trials of the machines took place in April before the opening of the show. The reports upon them are now printed. They include: 1) The report of the organizers. 2) The judges' report. 3) A report upon the milk samples from a bacteriological and chemical point of view.

The trials, for which the Royal Agricultural Society had offered gold and silver medals and prizes in money, were held at Grange Hill farm, near Auckland, Durham.

The organizers' report contains the conditions of the trials and the arrangements that had to be made owing to the great number of entries. The judges' report gives some introductory data, followed by short descriptions of the various machines and of the results obtained with them.

The ten following machines were tried:

- 1. Mjölkningsmaskin Omega, Flen, Sweden.
- 2. G. Bartram & Son, Melbourne, Australia.
- 3. Vaccar Ltd., London.
- 4. Lawrence Kennedy Ltd., Glasgow.

<sup>1</sup> See No. 1064, B. Sept. 1913.



5. Max Melkmaschinen Ges., Kopenhagen.
6. I. & R. Wallace, Castle Douglas, Scotland.
7. Gane Milking Machine Co., Auckland, New Zealand.
8. Nyeboe & Nissen, Kopenhagen.
9. Jens Nielsen, Kopenhagen.
10. Manus Milking Machine Co., Norrköping, Sweden.

The cows used for the trials, which lasted only six days, had not been milked with machines for two years. They did not suffer any injury from the trials.

The following are some comparative data on the results obtained with the Omega machine (First Prize) and with another competing machine. The two machines were tried on the same four cows. The following data refer only to the morning milking:

	Omega machine	Other machine
Average quantity of milk obtained per cow . . .	19.35 lbs.	16.54 lbs.
Average strippings per cow . . . . .	1.13 "	1.37 "
Duration of milking, including time for fitting on apparatus . . . . .	6.75 min.	10.5 min.

The next are the results obtained with a Vaccar machine (Second Prize) from a notoriously hard milker:

	Vaccar machine	Other machine
Quantity of milk machine-milked . . . . .	18.19 lbs.	17.94 lbs.
Strippings obtained by machine . . . . .	2.72 "	5.23 "
Duration of milking . . . . .	11 min.	13 min.

With the Manus machine the average per cow of the morning and evening milking was 31.50 lbs. and 2.99 lbs. strippings, and the time employed 11  $\frac{3}{8}$  minutes.

The Wallace machine is distinguished by its specially complete milk

The third report deals with the bacteriology and chemistry of the milk samples and includes data on the keeping qualities of the samples and their bacterial contents.

The report concludes with some hints for the makers of milk machines.

159 - **New Churn** (Austrian Patent No. 59977). — *Wiener Landwirtschaftliche Zeitsung* Year 63, No. 83, p. 944. Vienna, October 13, 1913.

Figs. 1 to 4 show this churn, in which the axis of rotation is at right angles to the axis of the churn itself, and which is provided with a butter worker. The butter-working apparatus is mounted in a frame which can be put into the churn at right angles to its axis of rotation, so that the cylinders of the butter-worker run parallel to the axis of the churn, which is shown in *c*; *a* is its cover, and *b* the rotating beater. The cylinders of the butter-worker, *e*, are mounted in the frame *d*, which can be slipped

the counter beaters *f*. The cylinders catch into each other by the wheels *h*, and may be worked by the crank handle *g*. As soon as the churning is made and the buttermilk drained off, the churn is so disposed that the axis of the butter workers are horizontal. Turning the handle *g*, the butter that has fallen on the worker is forced through between the cylinders and worked. Then the churn is turned round 180 degrees in the direction shown by the arrow *i*, and the butter which had fallen through the cylinders at the first working and had lodged on the side of the churn, is again worked by turning the crank *g* in the opposite direction; this operation can be repeated as often as is judged necessary.

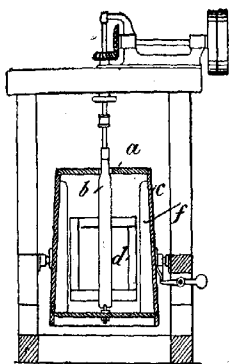


Fig. 1. - Churn during churning (vertical section).

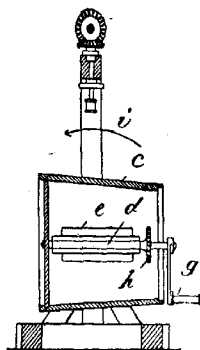


Fig. 2. - Vertical tangential section of churn, showing arrangement of butter-workers.

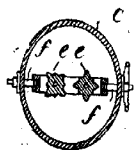


Fig. 3. - Section at right angles to that of fig. 2.

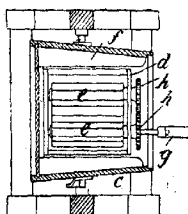
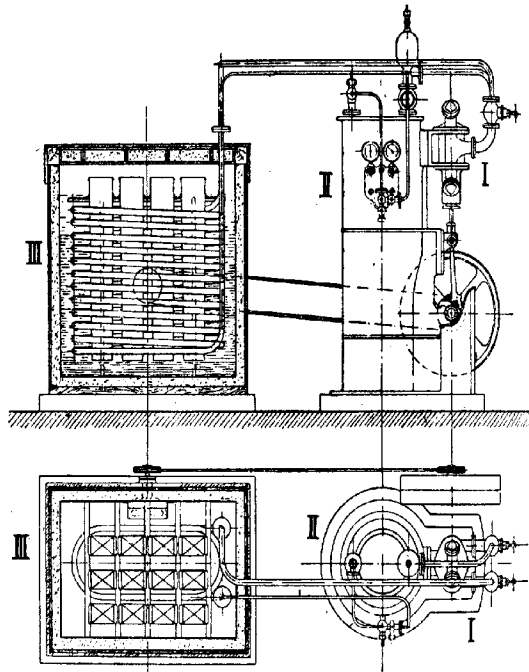


Fig. 4. - Horizontal section of churn.

160 - Trial of a Refrigerating Installation. — REZEK, I. in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 2, pp. 1-16, Vienna, August 25 1913.

The trial of the whole refrigerating plant was carried out between 1912 and 1913, inclusive, in the experiment-laboratory of the testing station for agricultural machines and implements of the College of Agriculture Vienna.

The writer begins by a detailed description of this refrigerating plant and of its working. It is a steam refrigerator using sulphur dioxide and



Refrigerator. — Elevation and plan.

chiefly for cooling purposes in dairies. The accompanying figures show the chief features of the ice machine, consisting of the compressor (I), the condenser (II) and the evaporator (III), which in this case is built in the ice generator. If the machine is not to be used for making ice, but for direct cooling of milk, the evaporating coil can be converted into a milk cooler over which the milk, without coming into contact with the sulphur dioxide, trickles along the coil containing the evaporating dioxide. Lastly, if the atmosphere of a milk room has to be cooled, the evaporating

is converted with a set of mostly cast iron ribbed pipes suspended the ceiling of the chamber to be cooled.

The price of the refrigerator with ice generator amounts to £216 10s, with milk cooler to £208.

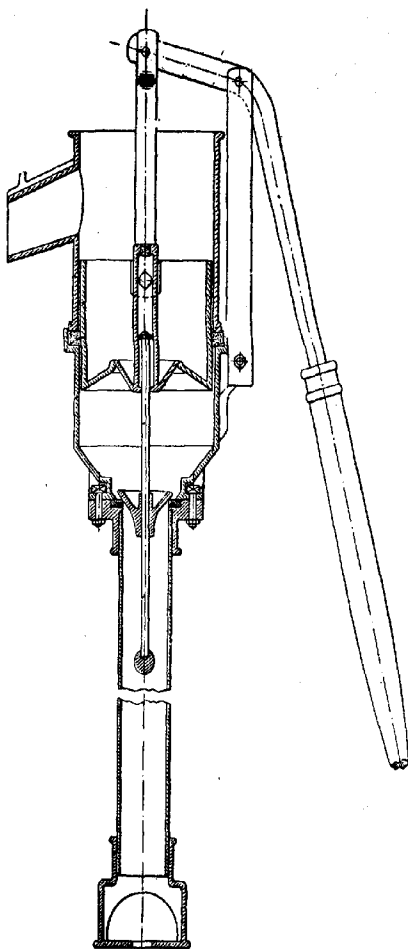
The writer then describes the experiments and their results, which are set into tables. At first experiments were conducted during which the action of cold by the cooling plant was ascertained by means of brine in ice generator. Then experiments were made as to its suitability for production of ice and for the direct cooling of milk.

Lastly the writer illustrates the economic aspect of the above plant by following table, which contains the most important data resulting from trial.

Work done	Date	Consumption of power in HP.		Consumption of water for cooling at temperature given in brackets	Performance in calories per hour		
		by machine including loss by transmission beltting	by machine without loss by transmission beltting		(a) Total	(b) per HP of motor	(c) per HP transmitted to compressor
Cooling of the brine of the ice generator within the limits of — to —5°C.	12.V.1911	2.57	2.42	litres 881 (10.7°C)	5000	1946	2066
	13.V.1911	2.45	2.36	860 (10.86°C)	5164	2108	2188
Production of ice from water at 12.4°C.	19.V.1911	2.26	2.14	900 (11.45°C)	2891	1277	1350
Cooling of a liquid by circulating over cooler.	12.V.1911	3.61	3.49	866 (10.53°C)	11714	3245	3356
	13.V.1911	3.12	3.03	886 (17.72°C)	9607	3079	3170

- Trial of a Pump for Liquid Manure. (11th Report of the Station for the Testing of Agricultural Machines and Implements at Hanover). — NACHTWEI, A. in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Prüfungs-Anstalten*, Year 7, Part 3, pp. 92-98. Berlin, 1913.

In the spring of 1911 one of these pumps for liquid manure was sent to the Hanover Machine-testing Station; since then it has been used on the Hildingen estate near Hanover and subjected to a long trial of resistance.



Liquid-manure pump. — Vertical section.

The pump, the details of which are protected by patents, is built with the object of combining the greatest simplicity and deviation with the most uniform performance. Thanks to its large valve openings and ample pipes, choking is rendered impossible. The writer gives a detailed description of the pump, the vertical section of which is shown in the accompanying figure.

The writer gives the prices of these pumps according to the heights at which they deliver the liquid and he mentions also a series of portable pumps built on this system and worked by hand or power. The final result is to the effect that the pump can be described as useful, practical, and reliable. It does not choke and performs its work well for a length of time.

### Review of Patents.

#### *Manure Spreaders.*

- Germany). Attachment with distributing wheel applicable to manure carts.
- Germany). Artificial manure spreader with oscillating hopper bottom.
- Hungary). Manure spreader.
- Austria). Manure spreader.
- Belgium). Manure distributor.
- France). Manure distributor.
- Switzerland). Liquid manure distributor.

#### *Sowing machines.*

- Germany). Drill.
- Germany). Furrow-press for drills.
- Germany). Potato planter with bearing wheels transformed into planting wheels.
- Germany). Potato planter with hopper and separate funnel-shaped receiver into which the potatoes fall and from which they are taken out by a series of clutches.
- Austria). Potato planter with shear-like clutches on planting wheel.
- Belgium). Potato planter.
- Hungary). Combined drill and hoe.
- Hungary). Hand sower.
- Hungary). Sowing wheel for sowing machines.
- Hungary). Steering gear for sowing machines.
- Hungary). Device for emptying the hoppers of drills.
- France). Device for changing the speed for sowing machines.
- England). Potato planter.

#### *Planting and harvesting machines.*

- Austria). Steering gear for vehicles, especially mowers.
- Hungary). Mower.
- Belgium). Mower with reaping attachment.
- Belgium). Improvement in mowers.
- (United States). Windrower attachment for mowers.
- France). Windrower attachment for mowers.
- France). Reaper with reversible motion.
- France). Improvement in reapers.
- England). Harvesting machine.
- Switzerland). Motor mower.
- Switzerland). Mower.

#### *Beet lifters.*

- Germany). Beet lifter with clutches consisting of forked levers on revolving disks.
- Austria). Hand beet lifter.
- Austria). Potato lifter.
- Austria). Two-row beet lifter.
- Austria). Potato lifter.
- Austria). Beet lifter.

62 860 (Austria). Throw wheel for potato-lifters.

60 571 (Hungary). Potato lifter.

255 501 (Belgium). Potato lifter.

255 456 (Belgium). Beet lifter.

22 685 (England). Potato digger.

*Threshing machines.*

61 906 (Austria). Thresher with straw press.

62859 (Austria). Attachment for removing chaff and short straw from thresher.

60857 (Hungary). Thresher elevator with guided motion.

255 223 (Belgium). Combined thresher and winnower.

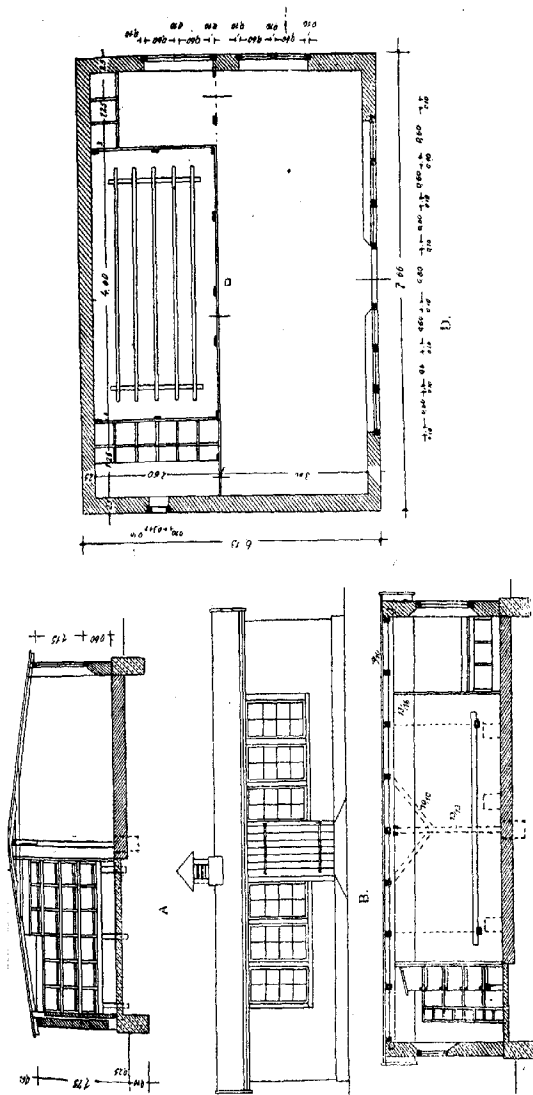
129124 (Italy). Bean thresher.

163 - **Fowl House for 80 or 100 Fowls.** — *Beilage zur Illustrierten Landwirtschafts Zeitung*, Year 33, No. 98, pp. 220-221. Berlin, December 6, 1913.

The annexed figures show the details of a fowl house for a head of small poultry or eighty of larger birds. This fowl house designed by the Chamber of Agriculture of the Duchy of Oldenburg cost between £ 28 and £ 36. The outer walls are of reinforced concrete and the roof of ruberoid.

The entrance is on the south side; it leads into the day-quarrel where the poultry, which occupy more than half of the total space of the building, the rest is taken up by a large roosting space and by two smaller spaces for the laying and sitting hens, containing also nests and brood boxes. The nests are placed in rows above each other and are easily reached by ladders. The brood boxes are on a level with the ground and a part of the floor set apart for the chickens. The average height of the building is about 6 feet.

(1) See No. 832, *B.* May 1912.



C. Fowl house for 80 or 100 birds. — A, Cross section. B, South elevation. C, Long section. D, Plan.



## RURAL ECONOMICS.

164 - Farming on the Share System and Monograph of a Large Estate and on this System during the period from 1891 to 1910. — JENNY, E. *Sozialwissenschaftliche Forschungen*, Part 171, pp. XVIII + 346 Munich and Leipzig, 1911.

The share system or metayage is a form of farming according to which the landowner provides the metayer with a certain extent of land for him to cultivate (under his direction and control) and receives in exchange a certain proportion of the gross produce. It differs from simple farming or payment of rent in kind, in that the quantity of produce in kind delivered by the cultivator of the land to the owner is not a fixed and absolute quantity but a fraction of the gross produce, as it is produced by the land in question. On the other hand the metayer farmer must supply all the labour required from the beginning to the end of the cycle of production, for the payment of a part of the produce for some special work can not be called metayage. The writer distinguishes three kinds of metayage: 1) The whole farm metayage; 2) Plot metayage; 3) Labour metayage ("corvée" farming). The three varieties have in common the characteristic of metayage, namely the proportional division of the gross produce and consequently of the profits, as well as the risks and losses, between both parties; where they differ is in the greater or lesser completeness and independence of the farmer in the demands upon the work and initiative of the owner, and in the extent of working capital which each puts into the concern.

The share system of farming, which dates back to the most remote times (it was practised in Babylon, India, Egypt, Rome) is at present still found in Italy, France, Russia, Rumania and in the South of the United States of America. The localities most favourable for this system are determined by social, climatic and economic conditions. It seems most suitable: 1) Where the contrasts in the distribution of landed property are more marked and where the lack of a prosperous class of peasant proprietors is more complete. 2) Where it is more difficult to secure sufficient good agricultural labour or where a number of very small landowners strive to be attached to the locality and not possessing sufficient land for their own object to working for wages. 3) Where the products of the farm are more consumed in the farm itself. 4) Where on the one hand an extensive agriculture is carried on according to routine and on the other hand certain crops require intense, careful and minute work. 5) Where the income from the crops from one year to another is greatest.

The writer shows that the metayage contract cannot be considered as a contract of partnership or a simple agreement for renting land or for hiring labour, but must be recognized as a special form of contract, *sui generis*.

The first fundamental function of the share system consists in determining and apportioning between the two parties the profits of labour capital and of labour according to what each contributed to produce.

The lower the rent value of the land is in comparison to the price of labour bestowed upon it by the metayer, the smaller will be the portion of the returns due to the proprietor and *vice versa*. The history of metayage shows that the share of the owner varies between one-tenth and one-half, while that of the metayer but rarely sinks below one-half. Of course such an arithmetical fraction does not express exactly the portion between the ground rent and the value of the labour except in exceptional cases. But there is, moreover, the third factor of production, working capital, the providing of which is a useful regulator for determining more exactly the relations between the two contracting parties, which are only roughly expressed by the proportional fraction.

In this respect the total or partial providing of live stock, machines, implements, and seeds is especially important in whole-farm metayage. In plot and labour metayage any rise in the ground rent is compensated advantageously for both parties by a more intense cultivation. In all circumstances, however, the fundamental principle of metayage must be maintained, namely that the produce is divided in proportion to the rent value and expenses of the owner on the one hand, and to the key value of the labour and expenses of the metayer on the other. Consequently any prestation or due of absolute amount, in money or in kind, as well as any labour not connected with the land under metayage, is to be avoided, for experience has shown that they lead to serious abuse, and excessive burdens on the peasant, and alter the proportionality of the share of profits.

When it is a question of new expenses (improvements, introduction of new branches of farming, etc.), the division of the gross produce in proportion to the cooperation of the two parties is the only just basis of settlement. This may be effected by one of the following methods: the parties contribute to the innovation in proportion to their portion of profits, or by the side of the main accounts a new account is opened for innovation, or again if the contribution of the two parties is much unequal, then the ratio itself of the divisions of the produce may be changed.

Similarly, in the special agreements as to improvements lasting a long time, the distribution of the expenses must be adapted as completely as possible to the ratio of the metayage; with this object, the time estimate for the amortization must be determined as exactly as possible; then the metayer, being rewarded by his part of the profits, will willingly submit to a greater demand upon his labour and will work at the improvements more conscientiously than any hired labourer.

The size of the metayer farms varies very considerably in different countries; in general, however, it is such as to guarantee the living of a family and at the same time to utilize completely all their labour.

The legal duration of the metayer agreement is generally one year; in practice, however, the tacit renewal has converted it into a contract lasting a long time, which is really the most suitable for this form of farming. In the use of metayage must, from its very nature, include a number of chances

of profit so as to attain a reasonably constant average. The chief function of metayage, which forms the principal justification of its existence, consists in the diminution of the risks of production, being a kind of insurance of the producers. It is especially to be noted that each of the parties ensures for himself the most necessary and often otherwise unattainable factor of production, namely land for the labourer and labour for the landowner, while exposing to the risk only that factor which for him is the cheapest (labour in the case of the labourer and ground rent for the landowner). This advantageous change of values, by diminishing the stakes, diminishes the absolute risk for both parties, and besides, by its compensating effect from year to year is one of the best means for counteracting the effects of bad seasons of crises due to falls in prices, of changes in labour and wage conditions also, frequently, of political disturbances. Consequently the yield of agricultural products is much better ensured by the metayage system than by any other, and this both from the labourer's and the landowner's point of view, as well as from that of national economy.

The eminent economic and social effects of metayage are undoubted. By equalizing the yields, it affords a solid basis to agricultural production which is often of a risky nature, and it mitigates or removes altogether the serious consequences of a defective distribution of landed property (as the reduction of the rural population to the state of a proletariat of day labourers, the apparition of the middleman and of the usurer with their train of evils, and absenteeism) and helps a disinclined population without capital to the possession of land and prosperity; it is the most favourable solution to the rural labour question and is a stimulus to the harmonious cooperation of the various social classes for the attainment of common aims and ensures in this manner the most beneficial technical, ethical and political results.

History teaches us that metayage is an excellent system for attaching people strongly and rapidly to the soil in new countries. It should be noted, according to the writer, prove a good system for home colonization.

In the last chapter of the first part of his work the writer gives an introduction to the second part, which is a monograph on a large metayage estate in the district of Odessa, an exhaustive review of the metayage system in Russia. He shows that metayage had to extend greatly in that country in consequence of the juridical development of the conditions of land ownership there obtaining, and that it had to take the special character of land and labour metayage. The peasants were bound to the land, but did not possess enough of it to supply their wants or to utilize economically their labour, so that they were forced to rent some fields (need or hunger rent. *Not- Nahrungs- Hungerpacht*); this led to insupportable conditions of usury and oppression. Such a state of things could be improved only by a conscientiously and firmly applied metayage. In fact metayage has in many parts of Russia favourably prepared the way for the reorganization of landownership which is being introduced. The metayage

lates that real metayage is practised in European Russia over an area of about 40 500 000 acres.

The estate described by the writer is situated in the South of Russia in the Odessa district, where a decidedly continental climate prevails. It is composed of four farms amounting altogether to 19 573 acres of extraordinarily fertile soil (black earth). Besides these natural conditions, the character of the people, in which a strong love of independence prevails, their economical position (very small proprietors under the form of "village-community") and the unfavourable labour conditions led to the adoption of metayage. Out of the 13000 acres of arable land, about 1900 were rented, 1350 were cultivated by the owner himself and the rest, or 9750 were farmed on the metayer system, which, during the twenty years, passed from plot metayage to labour metayage.

The writer gives the text of an agreement with a metayer. The most remarkable features are the sharp limits set to the obligation of labour (no work being made beyond the quota of the metayage), and the stress laid on punctuality and order. A minute description is given of the technique of metayer farming: distribution of the land to the peasants and contents of the agreement, summons of the metayers to work, oversight and control.

During the years 1891 to 1898 the share of the owner was one-third. The cost of cultivating one acre was about 9s 7d. The value of the rent of land being between 4s 8d and 5s 6d per acre, the metayer received 2 acres of land to cultivate for himself for every acre of land he cultivated for the owner.

From 1895 the rent of the land rose constantly; at first this increase was compensated by the improvement in the quality of the labour on the owner's fields. But when the rent value rose to 7s 10d and 8s 7d per acre, the quota of two-fifths was gradually introduced into the whole estate. The metayer received three acres of land for his use as compensation for every two acres for the landowner.

Metayage is especially adapted to diminish the risk due to the enormous stancy of the crops in the South of Russia.

Table I (p. 260) gives an idea of the range of the crops of spring wheat, rye, rye and winter wheat during the years 1891-1910.

Further causes of risks are the great uncertainty as to the effective cost of production, owing to the unsatisfactory condition of wages, the untrustworthiness of hired labourers, especially at harvest time, and the great oscillations in the prices of cereals not only from one year to another, but also in various seasons and even within the same month. The writer shows that all these risks are considerably diminished by the metayer system, both for the farmer and for the owner, if indeed they are not completely avoided, as he proves by schematic calculations that with metayage almost the same average results are obtained as by cultivating on one's own account, but that with the latter much greater deviations must be borne and a much higher risk than with metayer farming, owing to the much less considerable circulation of capital.

TABLE I.  
Returns in lbs. per acre.

Year	Spring wheat	Barley	Rye	Winter wheat
1891 . . . . .	147	147	281	—
1892 . . . . .	401	468	535	—
1893 . . . . .	1364	1578	1271	296
1894 . . . . .	743	1204	810	696
1895 . . . . .	703	1271	1284	1177
1896 . . . . .	77	140	160	—
1897 . . . . .	482	850	334	214
1898 . . . . .	703	1578	796	1217
1899 . . . . .	0	0	0	—
1900 . . . . .	187	294	120	0
1901 . . . . .	589	796	943	783
1902 . . . . .	0	147	281	1097
1903 . . . . .	575	769	736	681
1904 . . . . .	428	508	441	—
1905 . . . . .	401	468	—	—
1906 . . . . .	589	1084	1070	—
1907 . . . . .	482	769	214	174
1908 . . . . .	548	682	321	—
1909 . . . . .	415	743	535	441
1910 . . . . .	294	1084	943	1739
Average of the years 1891-1910	471.79	754.04	599.90	807.33

0 signifies that the crop was sown but not harvested.

— " that owing to the bad weather it could not be sown.

If 5s 1d per annum with metayage is accepted as the lowest limit of the net income per acre (to defray taxes, interest on mortgages, personal and general expenses) with which the owner can manage without having to put other money into the concern, then 14s 10½d more per acre must be added for cultivation and harvest expenses if the owner farms on his own

TABLE II.

Year	Average yield per acre of wheat, barley and rye	Farming by the owner. Deviation of the yield from the minimum	Metayage		Advantages	
			Yield per acre of total area	Deviation of yield from the minimum	of metayage	of farming by owner
	£ s d	£ s d	s d	s d	s d	s d
1891	10 9 1/2	9 2 1/4	4 3 3/4	— 9 1/4	8 4 3/4	—
1892	18 8 1/4	1 3 1/2	7 5 1/2	+ 2 4 1/2	3 s	—
1893	2 0 4	+ 10 4 1/4	16 1 1/2	+ 11 0 1/2	—	9 3 3/4
1894	1 8 7 1/4	+ 8 7 1/2	11 5 1/4	+ 6 4 1/4	—	2 3 1/4
1895	1 14 3 1/2	+ 14 3 3/4	13 8 1/2	+ 8 7 1/2	—	5 8 1/4
1896	4 4 3/4	— 15 7	1 9 1/4	— 3 4	12 3	—
1897	1 3 5 1/4	+ 3 5 1/2	9 4 1/2	+ 4 3 1/2	9 3/4	—
1898	1 18 1 1/2	+ 18 1 1/4	15 3	+ 10 2	—	8 0
1899	0 0	— 19 11 3/4	0	— 5 1	14 10 1/2	—
1900	8 1	— 11 10 3/4	3 2 3/4	— 1 10 1/4	10 0 1/2	—
1901	1 10 0 3/4	+ 10 1 1/4	12 0 1/2	+ 6 11 1/4	—	3 1 3/4
1902	5 0 1/4	— 14 11 1/2	2 0	— 3 1	11 10 1/2	—
1903	1 7 8 3/4	+ 7 9	11 1	+ 6 0	—	1 9
1904	17 9	— 2 2 3/4	7 0	+ 2 0	4 2 3/4	—
1905	17 7	— 2 4	7 0 1/2	+ 1 11 1/2	4 3 1/2	—
1906	1 13 0 1/4	+ 13 0 1/2	13 2 1/2	+ 8 1 1/4	—	4 11 1/4
1907	1 4 11 1/2	+ 5 0	9 11 3/4	+ 4 10 3/4	—	1 1/4
1908	1 9 0 3/4	+ 9 11	11 11 1/2	+ 6 10 1/2	—	3 0 1/2
1909	1 9 9 3/4	+ 9 10	11 11 1/4	+ 6 10	—	3 0
1910	1 11 9 1/2	+ 11 9 3/4	12 8 1/2	+ 7 7 1/2	—	4 2 1/4
					£3 10s 5 1/2d	£2 5s 5 3/4d

sum: 5s 1d + 14s 10 1/2d = 19s 11 1/2d. Table II shows by how much, in various years, the actual returns were above or below this minimum, further by how much in the average of 20 years this minimum has been exceeded by the owner when farming on his own account, and when farmed with metayage. Thus the returns of metayage in nine years exceeded

by £ 3 10s 5½ d those obtained by direct farming, while in eleven years they fell below them by £ 2 5s 5¾ d. This is a difference in favour of metayage of £ 1 4s 11¾ d in 20 years, or a yearly average of 1s 3d.

The profit and loss account of the estate shows for the twenty years a final profit of £ 27 9s 7 11s 2d on 12 148 acres under metayage, while calculation on the basis of the available figures shows a final loss of £ 159 17s 11d for direct farming by the owner. Besides, the latter accounts show that in six years the yearly loss ranged between £ 21 14s and £ 27 4s while in no year did the loss under the metayage system exceed £ 4s. The results of the comparison between metayage and the paying of rent in cash lead to similar results for the peasant. Though the net profit under the two systems works out nearly the same for the labourer, it must not be overlooked that metayage affords him the possibility of utilizing his labour at a rate that he could not otherwise realize, saving in quite exceptional cases. And even a small surplus of profit under the renting system never a sufficient insurance against the dangers of the renting system under the given conditions. With metayage both parties divide the profit and the eventual losses, while one insures the other to a certain extent, so the final favourable result is certain for both.

165 - Situation and Problems of Live Stock Breeding and Keeping in Intensive Agriculture. - MOMMSEN, CHRISTIAN. - *Arbeiten der Deutschen Gesellschaft für Züchtungskunde*, Part 17, pp. VI + 145 and 5 Maps. Hanover, 1913.

With the increasing intensity of farming, which has passed successfully from simple grazing to improved rotations with constantly increasing use of chemical manures and of hoed crops, the estimation in which live stock keeping and breeding were held sank; it only began to rise again with the greater prosperity of the population caused an increase in the price of animal products. The extent to which live stock is kept is to a certain extent dependent upon the conditions of the market and of prices, and to a much greater degree for pigs and sheep than for horses and cattle as the latter animals are often kept for purely farming considerations (teams, production of manure, utilization of by-products).

From a comparison between the statistical data on the number of live stock and the harvest results in Prussia and in the province of Saxony, it appears that the changes in the numbers are not explained by the results of the harvest in the corresponding year and that most probably there is very little connection between the two facts. It is not one abundant harvest alone, but a series of them, that leads to considerable increase in stock. There is no doubt that prices have a greater influence than harvests in this connection, and this is especially seen in the case of pigs, while since 1907 the increase in the numbers of cattle has stopped, in spite of the tendency of the prices of cattle to rise. Evidently other determining factors are here at work.

The extent to which stock is kept is in the main determined by the lowest harvests. In a certain sense here also the law of minima obtains. That such is the case, is also proved by the fact that live-stock keeping and breeding, not including sheep, is lowest in those parts of Saxony in which

highest average harvests are obtained, where absolutely and relatively greatest quantities of forage exist: in the districts with the most intensive agriculture, where sugar-beet growing is largely practised. Large estates are partly responsible for this evil. Another cause is the prevailing tendency to give too much prominence to the theory and practice of high class breeding, while at the present time it is the breeding of stock adapted to satisfy the wants of the population that is required.

Further, stock breeding is neglected by farmers on account of the ever increasing demands of intensive agriculture; it thus becomes less and less profitable and people get accustomed to consider it *a priori* as an unprofitable branch of farming. The means to remedy this state of things are: a better education of farmers in stock breeding, the technical and social improvement of workers in this field, the increase of special employees for stock breeding so as to get a more scientific management of this branch of farming, the demonstration of the organic connection between stock breeding and intensive farming.

In consequence of the increased intensity of farming, the production of odder has increased also and especially such as can be sold only with difficulty or not at all, as is the case with the by-products of hoed crops. In order to utilize them they are fed unsystematically and in too large quantities to the small number of animals, thus not only wasting much food, which represents a loss, but also injuring the health of the animals (which the writer investigates and demonstrates) and in this manner still further diminishing the profits on the stock. In order to diminish the loss, the number of head kept is still further reduced, the feeding in its turn gets more unstable and the results are always worse. It is not realized that a vicious circle is here followed and that the conditions of these farmers are such as to require rather an increase of their live stock, obtained by breeding animals themselves, and that only thus will they be able to utilize their masses of fodder. The writer gives some examples of feeds, with the calculation of their cost, for the systematic breeding of heifers, cows and heavy draught horses.

He then shows that pasturing is necessary for rearing young animals and that also in the interior of the country profitable pastures may be found. The manurial conditions of the farm are improved by turning a portion of the arable land into pasture, and keeping young animals at pasture allows live stock to be kept during the winter. Without considering the invaluable advantages for the health of the animals obtained by pasturing and which are of special importance for the beet farms, pasturing is itself profitable when it is suitably managed. The writer gives some practical hints on grazing and warns against overstocking.

The profits of stock keeping depend less upon the breed of the animals, than upon the way of keeping them and the object aimed at. Especially in farms with intensive hoed crops, better results would be obtained if more prominence were given to the production of milk and if fattening were combined with rearing young animals on pastures. The keeping of horses would turn out much cheaper if breeding were practised and the



work done by brood mares and young horses instead of with expensive purchased geldings.

The widely spread opinion that live stock keeping is *a priori* unprofitable is false; it becomes so by the way in which it is managed in the present system of intensive farming. The valuation given in the accounts to the fodder and to the manure produced in the farm itself contributes also to cause stock keeping to appear unprofitable. According to the writer the only proper way of fixing the price of such fodders is by considering their practical feeding value, the crop returns and also their cost of production, and not one only of these factors to the exclusion of the others.

In no case, however, should live-stock keeping be debited with the fodders at a price which is only exceptionally paid for a small portion of them and which cannot be realized for unlimited quantities.

166 - Intermediate Valuation of "not Marketable" Produce of the Farm I  
**Agricultural Book-keeping.** - BUDE, ALBERT in *Archiv für exakte Wirtschaftsforschung*, 11 Complementary Part, pp. 101-164. Jena, 1913.

After some introductory remarks on the systems of book-keeping adopted in farms, and on the general theoretical and practical bases of valuation, the writer discusses the valuation of the forage produced in the farm itself as either not marketable or only so to a limited extent, in its connection with agricultural book-keeping. He proposes to replace the more general expression "money value" by "intermediate value" (*Zwischenbewertung*), because it should indicate the transitory value that this fodder possesses at its departure from the fields to the productive stock and not its final food (or total agricultural) value.

The introduction of different intermediate values exerts no influence on the total net returns of the farm, but it can cause great differences to appear in the profitableness of the various branches of the farm; what is required is to determine such intermediate values for these products as represent rightly the relation of the field crops and productive stock to each other and to the whole farm.

With the help of tables containing data taken from practical farming the writer discusses the intermediate values of the above fodders from a physiological and economic point of view.

In drawing up an accurate estimate of the feeding requirements according to Kellner's rules, those commercial foods are chosen which with the least expense bring up the less concentrated foods of the farm itself to the normal ration required by the system of utilization that has been adopted. In so doing the value of the protein (according to Ehrenberg), which changes for every farm and from year to year, must be considered, and deduction must be made of the manurial value of the commercial foods.

Only those unmarketable products which are effectively consumed by the productive live stock are to be included in the intermediate valuation; those that are sold directly on the market or those still on hand at the end of the year for sale or consumption in the farm itself must be excluded from the account.

the feeding estimate, the price on the spot per lb. of starch-value mixture of commercial food necessary for systematic feeding (not the cheapest concentrated food) forms the basis of prices for the on of the unmarketable produce of the farm.

the starch-values contained in the foods of different concentration be considered as equivalent, and have to be valued differently in such ; produced in the farm. The measure of this lesser value of the less trated farm foods is given by the super-concentration of the purchased trateds, which are rendered necessary precisely by the lesser value of rmer. By super-concentration is meant the excess of protein and values contained in the purchased concentrateds over the average tration of the rations fed by the farm. The food produced in the self must thus pay the cost of this super-concentration; that is to e price of these foods must be diminished by the amount of the e caused by the purchase of the excess of concentration delivered farm.

he distribution of the value to be deducted among the various foods ed in the farm is then made according to the algebraic sum of the and deficiency of their content in protein and starch-value compared hat of the average total concentration required.

he greater yield due to the farm manure and expressed in money : be considered simply as the productive value or money value of anure. The total amount of the cost with the total gross yield of the ed and unmanured land should be compared in order to determine al value of the manure. But the account of the productive live stock not be credited, nor the crop account debited, with anything but an mediate value for the manure also.

he numerical calculation of the intermediate value can only be made basis of a comparative money valuation. Considering the exceedingly e composition of farmyard manure, its intermediate value can e determined on its content of fertilizing substances; the effect factors determining its value must instead be taken as a basis and fect produced by farmyard manure must be compared with the cor ding effect of artificials and the cost (= intermediate value) of farm- nure be inferred from the cost of mineral fertilizers. This is obtained he following equations:

. The cost of mineral fertilizers which give the greatest returns (*a*) s to the net returns produced by them (*b*) as the unknown interte value of the farmyard manure (*x*) is to the unknown relative net is produced by the latter (*y*), or:

$$a : b = x : y.$$

I. Money value (intermediate value) of the manure (*x*) + net return ed by it (*y*) = Value of farmyard manure (*c*), or:

$$x + y = c.$$

n this method of valuation all the principal factors which exert a ne influence on the money value of farmyard manure are considered:

1. Influence of the soil's need of farmyard manure ; 2. Increase of yield due to manure ; 3. Comparison of the effect of farmyard manure with that of chemical fertilizers ; 4. Influence of the economic situation. It follows, however, that this intermediate valuation can only be made exactly for one given year and on the basis of manuring experiments made in that particular year. If the first two factors determining the value of farmyard manure are called physiological factors, the two latter form the economic factors. The method of intermediate valuation is thus also founded on a physiological and economic basis.

In order to carry out the practical valuation of farmyard manure, the writer used as a basis two field experiments on light and heavy soils taken from the work of B. SCHULTZ of Breslau "Effect and money value of farmyard manure according to eight field experiments each lasting four years and he collects in several tables the average results of this calculation probable oscillations.

**167 - Cause of Difference of Income in Two Pure-bred Dairy Cattle Farms**  
ORRIS, D. H. in *Hoard's Dairyman*, Vol. XLVI, No. 12, pp. 319 and 329-330.  
Atkinson, Wisconsin, October 17, 1913.

The writer compares carefully with the aid of tables two dairy farms situated in favourable positions as to means of communication. They are respectively 400 and 160 acres in extent and the smaller of the two yields a managerial income \$3 380.62 higher than that of the other.

The following table shows the principal data of the inner economy of the two farms:

	Farm I	Farm II
Total area . . . . .	400 acres	160 ac
Arable land . . . . .	101 "	103 "
Total capital . . . . .	\$ 56 289.50	\$ 49 19
Fixed capital (amount and percentage of total) . . . . .	\$ 41 600 73.9%	\$ 22 80 46.1%
Working capital (amount and percentage of total) . . . . .	\$ 14 689 26.1%	\$ 26 39 53.9%
Investment in cattle . . . . .	\$ 4 990	\$ 21 51
Number of head . . . . .	61	67
Total receipts . . . . .	\$ 8 750.90	\$ 13 81
Live stock products sold . . . . .	\$ 3 030.00	\$ 3 31
Live stock sold and increased inventory of live stock . . . . .	\$ 3 476.50	\$ 7 31
Sale and increased inventory per cattle unit . . . . .	\$ 18.22	\$ 11
Total running expenses . . . . .	\$ 4 234.77	\$ 4 41
Expenses for labour . . . . .	\$ 2 270.40	\$ 1 61
Printing and advertising . . . . .	\$ 11.00	\$ 4
Interest, 5% on capital . . . . .	\$ 2 814.47	\$ 2 4
Total expenses . . . . .	\$ 7 899.24	\$ 9 5
Net results (managerial income) . . . . .	\$ 851.66	\$ 4 2

The extent of arable land is very nearly equal in the two farms, while running expenses are nearly the same.

The total expenses are even greater by \$1680.22 on the smaller than on larger farm. Consequently the great difference in the net results can only be explained by the difference in the receipts; it comes chiefly from the sale of produce and from the difference in the increase of inventory. The writer holds the opinion that the higher managerial income of the smaller farm is almost entirely due to more judicious breeding, selecting, testing and advertising.

**Sugar-Beet Farming in Austria-Hungary.** — SEDLMAYR, E. C. in *Mitteilungen der landwirtschaftlichen Lehranstalten der K. K. Hochschule für Bodenkultur in Wien*, Vol. II, Part 2, pp. 245-305. Vienna, November 29, 1913.

The writer describes the conditions of farming (exclusive of the conditions of capital and profitableness) of ten large farms which grow sugar-beets in Austria-Hungary. In only one case was the extent of the farm less than 500 acres and in two cases it was above 2500. The data given are the result of an enquiry and they embrace: conditions of climate and means of communication, labour and wages; size of property and extent of various crops; farming proper, rotation, manuring, tillage, yield of crops; live stock: draught animals (cost of a day's work of a horse and of a cow), productive animals (milking, fattening and breeding); dead stock; veterinary keeping; accessory industries.

**Cost of Rearing a Calf.** — CLAUSEN in *Landwirtschaftliches Wochenblatt für Schleswig-Holstein*, Year 63, No. 44, pp. 883-884. Kiel, October 31, 1913.

The writer gives a summary of the cost of rearing a calf on the basis of the quantities of food administered and corresponding in nutritive value to Kellner's rules for feeding. The cost of attendance, rent of stall, insurance, and interest of working capital on the one hand, and the value of the manure on the other hand, are not included in the account. Whole milk is valued at 6.41 d per gal., and the skimmed milk at 1.6d per gal. Concentrated foods and hay are taken at the market price.

The weekly costs of food rise at first on account of the increasing quantity of whole milk given. In the fifth week a part of the whole milk is replaced by skimmed milk, in the seventh week whole milk is completely replaced, and in its place meal, crushed linseed and oats are fed.

The cost of rearing a six-months-old calf amounts to £6 14s 3d inclusive of initial cost. With a live-weight of 385 lbs., the cost per cwt. works out at 11s.

	Cost of food	Initial value and cost of food		Cost of food	Initial value of bee
	£ s d	£ s d		£ s d	£ s d
At birth . . . . .	—	1 19 2½	14 weeks . . . . .		1 15
1 week . . . . .	4 1½	2 3 4	15 " . . . . .		4 18
2 weeks . . . . .	5 5¼	2 8 9¾	16 " . . . . .	together	5 1
3 " . . . . .	6 2	2 14 11¾	17 " . . . . .	18 1¼	5 4
4 " . . . . .	7 3¼	3 2 3½	18 " . . . . .		5 7
5 " . . . . .	5 10	3 8 1½	19 " . . . . .		5 10
6 " . . . . .	4 3	3 12 4½	20 " . . . . .		5 14
7 " . . . . .	2 8¼	3 15 0¾	21 " . . . . .		5 17
8 " . . . . .	2 9¼	3 17 10½	22 " . . . . .		6 0
9 " . . . . .		4 0 9½	23 " . . . . .	together	6 4
10 " . . . . .		4 3 9	24 " . . . . .	1 3 6¼	6 7
11 " . . . . .	together	4 6 8¾	25 " . . . . .		6 10 1
12 " . . . . .	14 9	4 9 8	26 " . . . . .		6 14
13 " . . . . .		4 12 7½			

170 - Observations on the Practice and Profitableness of Bee-keeping in Switzerland in 1912. - Report of the Swiss Peasants' Secretariat, in *Schweizer Bienenzeitung*, Year XXXVI, No. 12, pp. 459-466. Aarau, December 1913.

This paper is based upon the accurate book-keeping of twenty-five Swiss bee-keepers with an average of 25.5 hives each. The total capital invested in each undertaking is £99 3s 6d, or £3 17s 10d per hive. The average expenditure of time per undertaking is 149 hours, or 5h. 59 per hive. The gross returns in cash are made up as follows:

	Per bee-keeper	Per hive	Percentage
	£ s d	£ s d	—
Honey . . . . .	14 3 4	11 2	72.65
Swarms . . . . .	4 4 2	3 3	27.45
Comb, etc. . . . .	1 3 0	11	5.90
Total . . . . .	19 10 6	15 4	100.00

The expenses and cost of production are the following :

	Per bee-keeper £ s d	Per hive £ s d	Percentage —
Sugar . . . . .	6 3 10	4 10½	28.96
Small implements . .	13 6	6	3.15
Expense for hives . .	19 10	9	4.55
„ for bee houses . .	18 3	8½	4.18
Sundries . . . . .	1 14 11	1 4½	8.23
Work of bee-keeper . .	5 18 3	4 8	27.64
Total outlay . . .	16 8 7	12 10½	76.71
5% interest on capital	4 19 2	3 11	23.29
Total cost of production	21 7 9	16 9½	100.00

If the returns for swarms, comb, etc., are deducted from the general cost of production, the remainder is the cost of production of the honey. It amounts to £16 0s 7d per bee-keeper, or 12s 7d per hive; with an average production of 312 lbs. of honey, this makes 1s 0¼d per lb.

With an outlay of £16 8s 7d and gross returns amounting to £19 10s 6d, net returns are £3 1s 11d per keeper, or 2s 5d per hive, which equal to 3.1 per cent. on the capital invested. The average income of a beekeeper is thus (labour plus net returns) £9 0s 2d per keeper or 0s 4d per hive.

**Foundation of a Land Valuation Office by the Swiss Peasants' Association.**  
— *Schweizerische Landwirtschaftliche Zeitschrift*, Year XL4, Part 2, p. 1247. Zürich, December 24, 1913.

The Swiss Peasants' Association founded a land valuation office on January 1 of this year at Brugg, with the following programme :

1. Preparing valuations for private persons, for credit institutions and for the State.
2. Assisting in carrying out official valuation: a) by preparing opinions on the average values in the various localities, by grouping the soils into classes, by drawing up score cards for individual valuations and underpinning the latter; b) by conducting courses on the subject.
3. Carrying out scientific work in agricultural appraisalment under the direction of the president of the Swiss Peasants' Secretariat and in connection with the section for the research on profitability, as, for instance: preparing the basis for real estate valuation in Switzerland; b) drawing up tables to facilitate the appraisalment of land; c) preparing and collecting the systems of valuation of special groups of agricultural capitals (fruit trees, forest trees, vineyards, dead stock, improvements, buildings and the like); d) critical elaboration of official regulations on appraising; discussion of recent publications in land valuation literature.

- 172 - **Institution of an Agricultural Book-keeping Office at the German Section of the Council of Agriculture for the Kingdom of Bohemia.** — *Land- u. Forstwirtschaftliche Mitteilungen*, Year 15, No. 23, p. 257. Prague, December 1, 1913.

According to the resolution of October 25, 1913, a division for agricultural book-keeping and farming advisorship was instituted at the German Section of the Council of Agriculture for the Kingdom of Bohemia; it will soon commence work.

- 173 - **Association for Obtaining Probatory Power for Agricultural Book-keeping and for Furthering the Science of Farm Management.** (1) BURG. — *Report of the Transactions of the First Meeting on February 18, 1913.* Part 1, pp. 26. — HOWARD. — *Report upon the Origin and Development of our Endeavours up to the Present.* Part 2, pp. 18. Berlin, 1913.

The above Association, which commenced its existence with the meeting of February 18, 1913, in Berlin, proposes:

1. To secure for the book-keeping of farmers the same probatory power as that already recognized by law as being possessed by the books of other professions.

2. To afford the followers of the various systems of book-keeping a place in which to express their views and to come to mutual understanding.

3. To promote the study of the science of farm management.

4. To awaken in the members of other professions a better understanding of the conditions of existence of farming, and thus to diminish the existing conflict of interests between town and country.

The Association has its seat in Berlin and holds yearly one ordinary general meeting. The two publications hitherto issued by the Association contain precise data on the preliminaries and the circumstances of its foundation, the means to be used for the attainment of its objects and its statutes.

#### AGRICULTURAL INDUSTRIES.

- 174 - **Influence of Pasteurizing on the Fat Globules of Cream. Preliminary Research.** — HAGLUND E. in *Nordisk Mjølteridning*, p. 485. 1913.

According to the researches of M. Barthel (*Milch Zeitung*, 1904, p. 47) the well-known fact that separating becomes less complete after preliminary pasteurization depends upon the fact that the fat globules get broken by the rapid movement of the milk during pasteurization. It is therefore essential for the economy of the dairy not to allow the agitator to work more than is strictly necessary. Similarly the widespread opinion that pasteurized cream gives a buttermilk richer in fat than that yielded by non-pasteurized cream leads to the belief that pasteurization has the same effect on cream as on milk, but on the other hand the tendency of the fat globules to agglomerate at a high temperature renders a contrary effect in pasteurization possible.

The writer, chief of the dairy section of the Central Agricultural Experiment Institute in Sweden, submitted this problem to a preliminary investigation, which yielded the following result:

employing Gutzzeit's method (1) it has been demonstrated that pasteurization caused a decrease in the number of the fat globules, on an average 1300 to 1689 per  $1 \mu^3$  of cream; that is to say a certain number of globules had agglomerated to form larger globules. The average volume increased from 12.95 to 18.93  $\mu^3$ , and a classification of the globules according to their size showed that the number of globules of 2.5  $\mu^3$  had been the same, whilst the number of those of at least 5  $\mu^3$  had increased 7 to 11 per cent. A comparative examination between cream that had been heated only and cream that had been heated and stirred at the same time showed that heating alone does not cause the running together of the globules, but that this is facilitated by mechanical agitation.

**Bacterial and Enzymic Changes in Milk and Cream at 0°C.** — PENNINGTON, E. and COLLABORATORS. (Food Research Laboratory, U. S. Dep. of Agr. Washington) in *The Journal of Biological Chemistry*, Vol. XVI, No. 3, pp. 331-368, Baltimore, December 1913.

In a previous paper (2) the writers have shown that milk stored at 0°C. undergoes market proteolysis, and the present investigations were undertaken to determine how far the changes were brought about by bacterial action and how far they were due to enzymes.

Commercial milk and cream were obtained from a dairy certifying to a grade of purity and four sets of samples were prepared as follows:

1. Sterilized for 30 minutes in an Arnold steam sterilizer on three consecutive days, and then reinfected with organisms precipitated from the raw milk thus limiting the changes to those brought about by bacterial action alone.

2. Received 0.1 per cent. of formaldehyde to limit the changes to those that about by enzyme action alone.

3. "Raw" or untreated milk, where both the above factors were working in combination.

4. Sterilized, but not reinfected, to serve as a control.

After treatment the milk and cream were maintained for 35 days at 0°C. in a mechanically refrigerated room, and at the end of a week the different sets were sampled and subjected to chemico-bacteriological, and zymochemical analyses.

The proteolysis of casein, the fermentation of lactose, and the hydrolysis of fats proved to be due to the action of bacteria, while the proteolysis of albumen was the result of enzyme action. The two varieties of oxidase, the varieties of reductase and the catalase retained their activity in the milk after the prolonged exposure to a temperature of 0°C. The guaiac oxidase and aldehyde reductase in milk appeared to be derived from bacteria while the other enzymes were probably partly due to the bacteria already native to the milk or the cream itself.

*Landw. Jahrbuch der Schweiz*, 1895, p. 539.

*The Journal of Biological Chemistry*, Vol. IV, p. 353, 1908.

(Authors note).



The bacterial content of the raw and reinfected samples was estimated by plating out and incubating the plates at 37°, 20° and 0°C; the samples incubated at 20° and 0° C. gave larger counts than those incubated at 37°. Milk after 35 days contained over 300 million bacteria per cc., and cream after 21 days contained 120 million bacteria per cc. Almost invariably *Micrococcus aurantiacus* (Cohn), and *Micrococcus ovalis* (Escherich), which belong to the group of acid-formers, were the predominant organisms of both raw and reinfected sterilized milk and cream.

176 - A New Butyrometer for Determining the Amount of Fat in Cheese  
NILES, H. in *Molkerei Zeitung*, Year 27, No. 86, pp. 1665-1666. Hildesheim, Germany 5, 1913.

This butyrometer, constructed by Dr. A. Hess and put on the market by Wilhelm Vick of Rostock, Germany, consists of a butyrometer tube, one end open and the other closed, and reduced in the middle to a tube which bears the scale. The upper and lower parts contain each 10 cc. and each division of the scale corresponds to 1 per cent. of fat. Half-centages can also easily be read.

The instrument is used as follows: 5 grams of finely grated cheese are put into it and then 10 cc. of sulphuric acid of S. G. 1.41. The lower part of the butyrometer is plunged into boiling water and gently shaken until its contents are dissolved and the liquid has become a uniform color of a brownish violet colour. Undissolved particles are easily noticed, for they float as yellow dots on the surface of the liquid. When all the cheese is dissolved, which takes place after 8 to 10 minutes, a further 10 cc. of sulphuric acid is added, this time however of S. G. 1.82. The instrument is then closed, well shaken and centrifugated for 5 minutes with the closed end towards the axis of the machine. The liquid then passes from the larger lower space into the upper one and fills a portion of the graduated tube, so that the position of the column of fat that has separated out can be easily regulated by the stopper. The instrument is then for a short time in a water bath at 65 to 70° C. (149 to 158° F.) and then the amount of fat is read off on the scale after having previously set the definite division between the fat and the rest of the liquid against the 0 of the scale by drawing out or pushing in the stopper; the bottom limit of the meniscus is to be taken.

In using the instrument, attention must be paid to its perfect dryness and to the fine division of the cheese. Soft cheeses can be introduced into the upper part of the butyrometer by a spatula, the acid added, the instrument closed, turned round and the casein dissolved in the upper part; the second addition of the acid is made and the rest of the test carried on as with the hard cheeses.

The writer made comparative determinations with 12 different cheeses at the Dairy Institute at Güstrow. They showed that the results of the new instrument agree well with those of the analytical method, while Wendler's new "Sal" method often gives too low values. The difference between this new method and the analytical method ranged from -0.2 to +0.45 per cent.

the writer considers this new method as the simplest and most exact to known and very suitable when many determinations have to be

**Sultry Milk in Cheese-making: its Detection and Prevalence.** — STEVENSON, W. (asst of Scotland College of Agriculture) in *The Journal of the Board of Agriculture*, L. XX, No. 9, pp. 772-773. London, December 1913.

In 1912 the cheeses from a well-known farm in Ayrshire, which has reputation for the quality of its Cheddar cheese, developed an unpleasant flavour in the later stages of ripening. The cause of this deterioration was investigated by incubating the milk from each cow, separately, at 98° F., 12 hours. At the end of that time, a firm, close curd free from bubbles with a pleasant flavour was taken to indicate that the milk was pure. A partial or total dissolving of the curd and the presence of gas showed the milk had been contaminated either by dung or by inflammatory germs from the cows' udders. The results of the tests showed that only 1 per cent. of the samples were irreproachable, and other herds similarly gave an even lower percentage. In order to use the unsound milk as economically as possible, it was pasteurised at 160° F. before being added in bulk and by this means cheeses of excellent quality were obtained.

**A New Method of obtaining Milk Serum and its Importance in the Detection of Watered Milk.** — SANFELICI, RICCIARDO in *Rivista Scientifica del latte*, nr. 3, Part 5, pp. 65-67. Reggio-Emilia, October 1913.

In his method is carried out in the following manner: 6 cc. of pure 50 per cent. tartaric acid are added (without warming) to 300 cc. of milk; the whole is mixed, and left standing for 2 minutes until coagulation is complete. The mixture is filtered through a corrugated filter into a measuring cylinder and poured through again until the filtrate comes through clear.

In order to discover whether the milk has been watered, the specific gravity of 60 cc. of the clear filtrate at 15° C. is determined by means of a L. Quevenne lactometer (1). If the temperature of the serum is above 15° C. the lactometer reading must be corrected as shown in the accompanying table. (The degrees of the lactometer correspond to the hundredths of the excess the S. G. over 1: thus 29.2° = S. G. 1.0292).

To be obtained from I. Greiner of Munich.

(Ed.).

Temperature of the serum	Amount to be subtracted from the figure found	Temperature of the serum	Amount to be to the figure
deg. C.		deg. C.	
0 . . . . .	1.0	16 . . . . .	0.1
1 . . . . .	1.0	17 . . . . .	0.2
2 . . . . .	1.0	18 . . . . .	0.3
3 . . . . .	1.0	19 . . . . .	0.4
4 . . . . .	0.9	20 . . . . .	0.5
5 . . . . .	0.9	21 . . . . .	0.7
6 . . . . .	0.9	22 . . . . .	0.9
7 . . . . .	0.8	23 . . . . .	1.1
8 . . . . .	0.7	24 . . . . .	1.3
9 . . . . .	0.6	25 . . . . .	1.5
10 . . . . .	0.5	26 . . . . .	1.7
11 . . . . .	0.4	27 . . . . .	1.9
12 . . . . .	0.3	28 . . . . .	2.1
13 . . . . .	0.2	29 . . . . .	2.4
14 . . . . .	0.1	30 . . . . .	2.7
15 . . . . .	0.0		

The specific gravity of the serum of milks from the district of (Italy), varies only between 1.028 and 1.030, and thus allows the detection of very small amounts of added water.

Out of 100 milks to which the writer added 5 per cent. of water were detected by this method, while determination of the solids-not-fat and S. G. of the whole milk (in comparison with the minima of the dist) gave only 50 and 8 detections respectively.

## PLANT DISEASES

### GENERAL INFORMATION.

**The Importation of Cotton Seed into Algeria.** — *Bulletin Agricole de l'Algérie et de la Tunisie*, Year 19, No. 18, pp. 374-376. Algiers, 1913.

In order to complete the decree of the President of the French Republic dated September 2, 1912, fixing the conditions concerning the importation of cotton seed into Algeria, the Governor General of Algeria has ordered under date of Aug. 12, 1913, as follows:

Art. 1. — Cotton seed of whatever source may be imported into Algeria only through the ports of Algiers, Oran and Bône and the post of Gardimaou.

Such seeds shall be disinfected on their arrival in the colony by the officials of the Phylloxera Service.

Art. 2. — This order shall be carried into effect by the Prefects of Algeria, the Customs Service and the Phylloxera Service, according as each severally concerned.

### BACTERIAL AND FUNGOID DISEASES.

**Chemical Means for the Control of Parasites of Farm Crops.** — MOLT, E. in *Föhdling's Landwirtschaftliche Zeitung*, Year 62, Part 23, pp. 822-838. Stuttgart, December 1, 1913.

A list of the chemical means, known at present, for the control of animal and vegetable parasites of farm crops. The list comprises remedies based on the following substances: copper, sulphur, arsenic, formalin, borolineum, soap, nicotine, fumigation with prussic acid.

**A Disease of Red Clover.** — BACCARINI, P. in *Bullettino della Società Botanica Italiana*, 1913, October-November, No. 7-8, pp. 118-121. Florence, 1913.

Of recent years the crops of red clover (*Trifolium pratense*) in the Val d'Elsa (Tuscany) have been subject to a very serious disease, with the result that many farmers have ceased to grow it. The disease threatens to become more serious owing to its rapid spread beyond its original limits. It

is known amongst the farmers as "incappucciamento", and is characterised by an excessive tufty growth and almost entire absence of flower shoots. With repeated mowing, the disease becomes worse, so that in the second year the still vigorous plants take the form of thick tufts or cushions of dwarf shoots yellowish green in colour; the new shoots lack vigour and become weaker and die; they are followed by even more delicate growth, until finally all signs of vitality disappear. The tap-root and its roots with their bacterial nodules appear quite normal.

According to this preliminary report given by the writer, the appearance of the disease, its development and the continual spreading to new areas indicate its infectious nature. Various fungi and insects have been found in the clover, but none of these can be looked upon as a specific cause of the disease. Further, several bacteria have been isolated from the diseased plants, of which one has proved to be pathogenic. Infection experiments with this particular organism have given positive results, but it is still necessary to confirm them and to work out the conditions of infection in the field, and the part played by the insects.

182 - **Wart Disease of Potatoes: *Chrysophlyctis endobiotica* (*Synchytrium endobioticum*)** (1). — Communicated by Prof. JAKOB ERIKSSON, of the Phytopathological Section of the Central Agricultural Experiment Institute, Sweden.

Since the appearance of the potato disease, *Phytophthora infestans* (Mont.) de By., in Europe, no new affliction of this plant has equalled in gravity the wart disease, caused, as is well known, by *Chrysophlyctis endobiotica* (*Synchytrium endobioticum*, S. Solani).

In England wart disease has been the object of extensive investigation and research since 1909. Scientific research has been carried out in order to discover the nature and the conditions of life of the fungus. Practical experiments have been conducted under the direction of the Board of Agriculture. Every year inspectors have been sent into the infected or suspected districts in order to determine the extent of the infection as well as its intensity in the various localities. In several places experimental fields have been instituted with the object of ascertaining how far dusts with fungicide powders or mixing them with the soil reduced or prevented the disease, and whether the different varieties of potatoes were all equally affected by the disease.

The researches and experiments made have demonstrated that the disease spreads slowly but steadily; the contagious matter preserves its virulence in the soil for years, and all the fungicides hitherto tried have proved ineffectual to prevent or diminish the mischief.

By the side of these negative results, it has however been observed that the different varieties of potatoes are very unequally affected by the disease. According to their resistance they may be classed as follows:

(1) See on this subject B. Dec. 1910, p. 361; No. 610, B. Feb. 1911; No. 1007, B. March 1911; No. 1911, B. June 1911; No. 3280, B. Nov-Dec. 1911; Nos. 219, 221 and 440, B. Jan. 1912; No. 423, B. Feb. 1912; No. 976, B. June 1912; No. 1100, B. July 1912; No. 182, B. Feb. 1913; No. 751, B. June 1913; B. July 1913, p. 1006. [Ed.]

a) Varieties that are completely or practically immune from the disease: Langworthy, What's Wanted, Golden Wonder, Peacemaker, and Discovery (St. Malo Kidney).

Varieties generally immune from the disease, but liable to it if grown in infected soil: Aberlady Early, Milecross Early, Snowdrop, Southern Star, Findley's Conquest, Sutton's Abundance, Sutton's Wonder, Sutton's White City, Chiswick Favourite, Dobbie's Favourite, Troffer, The Provost, Davie's Laird and Schoolmaster.

Varieties seriously attacked in infected soil: Puritan, Sharpe's Express, Epicure, Myatt's Ashleaf, May Queen, Midlothian Early, Maryland Queen, Royal Kidney, British Queen, Radium, Queen, Colleen, Lady Llewellyn, Sutton's Harbinger, Sutton's Victory, Sutton's Satisfaction, Windsor Castle, Northern Star, Eldorado, President, Tyne Kidney, The Scot, The Bruce, King Edward Up-to-date and similar varieties such as Factor, Table Talk and those of Cornwall.

Among the early potatoes the following are recommended: Snowdrop, Wonder and Abundance. The two latter yield an abundant product and of good quality, but in rainy years they are very liable to *Phytophthora* leaf-curl, which render spraying with Bordeaux mixture indispensable. Among the late varieties the following are recommended: The Wonder, Davie's Laird, Golden Wonder and Langworthy. If the soil is infected the two latter are to be preferred.

It must be remarked that this classification is based only on experiments in England. Our knowledge of several other diseases of plants has shown us that for a given plant resistance to a certain destructive fungus is always the same, but that it can vary in different countries and according to the latitudes under which it is grown.

In order to determine to what extent the 1 per cent. formalin solution used in Sweden against black scab (which appeared in the country for the first time in October 1912) (1) was capable of destroying the parasite in the soil, the Experiment Station carried out some special experiments in the summer of 1913 on three small plots, one 1 sq. metre (a little over 11 sq. ft.) and the other two 0.3 sq. m. (3 sq. ft.) in extent. These plots were separated from the adjoining ground by a cement or zinc partition descending into the soil to a depth of over 3 ft. At the beginning of spring a great number of seriously diseased potatoes were mixed with the soil of the three plots.

Somewhat later, about a fortnight before planting, the two small plots were watered with a 1 per cent. formalin solution at the rate of 10 litres per sq. metre (1.8 gals. per sq. yard), whilst the large plot was left untreated. On May 20 the three plots were planted to potatoes; in one of the small plots two tubers of Magnum Bonum were placed, and in the other two of Up-to-date. This latter variety is recognized in England as being very liable to the disease. In the third and larger plot five tubers of Up-to-date were planted. In the three plots the plants grew vigorously.

during the summer and autumn, presenting the appearance of bad plants. On September 8 the potatoes were lifted. It was then found all the tubers gathered from the plots that had been watered with formalin solution, namely 17 tubers of Up-to-date and 13 of Magnum Bonum, completely free from black scab, whilst out of the 43 tubers lifted from larger untreated plot, 39 showed characteristic eruptions of the disease. The infection however was not very severe on any of the five plants, so no doubt to the fact that the contagious matter, having been introduced into the soil only in the spring and not in the preceding autumn, had not penetrated into the soil.

Anyhow, the above experiment shows that a 1 per cent. formalin solution at the rate of 1.8 gals per sq. yard has the power of destroying the contagious matter in a soil infected by the potato black scab fungus. In the case of a soil that has been infected for years a stronger solution will be necessary, namely 2 or 3 per cent.

183 - **American Gooseberry Mildew (*Sphaerotheca mors-uvae*) new from France.** — FORX, ETIENNE in *Journal d'Agriculture pratique*, 1913, Vol. 49, pp. 717-719. Paris, December 4, 1913; and in *La Revue de Phytopathologie appliquée*, Vol. I, No. 13, pp. 165-167. Paris, December 5, 1913.

The writer records a small outbreak of American gooseberry mildew in the centre of France. He indicates the present distribution of the disease in northern and central Europe and the regulations adopted by some of the countries concerned (1) together with the methods of control at present in use (2).

184 - **The Effect on Carrots and Spinach of being grown in Soil infected with Finger-and-Toe.** — FRON, G. in *Journal d'Agriculture pratique*, 1913, Vol. II, No. 13, pp. 730-731. Paris, December 4, 1913.

Several plots of cabbages were partly destroyed in 1912 by *Plasmaphora Brassicae*. The cabbages were succeeded by a crop of carrots, which only flourished in the parts free from disease. The same effect was noted in the case of spinach grown under similar conditions. The roots of the carrots were not examined, and no obvious disease was noticed on those of the spinach. They showed, however, certain deformities the cause of which has not yet been determined. Microscopic examination did not reveal the existence of the finger-and-toe fungus in the tissues.

(1) An editorial note in the *Revue de Phytopathologie appliquée* states that in France where the disease was noticed and studied for the first time in June 1913, the Ministry of Agriculture, on the advice of the "Comité consultatif des Epiphyties" has requested the Prefect of the Department of Loiret to issue immediately, by means of a provisional decree, such regulations as may be considered necessary for limiting as far as possible the damage due to the disease.

(2) See No. 1301, B. Nov. 1913.

**Streak Disease of Sweet Peas.** (1) — *The Gardener's Chronicle*, Vol. LIV, No. 1409, p. 459. London, December 27, 1913.

The National Sweet Pea Society offers a prize of £10 10s and the Gold Medal of the Society to the first person furnishing a cure for streak disease of sweet peas. Communications should be addressed to the Secretary, D. Pell, Greenford, Middlesex.

***Ascochyta Gerberae* n. sp., Parasite of *Gerbera Jamesoni*, an Ornamental Composite.** — MARFET, LUIGI in *Rivista di Patologia Vegetale*, Year VI, No. 9, 3 pp. Pavia, 1913.

For the last two years the specimens of *Gerbera Jamesoni* possessed by the Botanic Garden at Pavia, and obtained partly from Antibes, have their leaves damaged by a Spheroidaceous fungus which has spread considerably in 1913. The disease appears as a small nut-coloured circular spot, which gradually increases to some centimetres in diameter. And as on the same leaf several such spots are produced, these run together and at last completely spoil the leaf, which wilts. The spots become dark brown in colour and are either sharply defined or their edges shade off to a wine colour; they occupy both sides of the leaf and present concentric rings. Observing them with a magnifying glass they appear dotted with small prominent bodies, the pycnidia of the fungus, which the writer refers to the genus *Ascochyta* and considers as a new species and gives the name of *A. Gerberae*.

The writer does not know whether the disease has developed in other localities; anyhow, considering the rapidity with which it spreads, it is advisable, failing practical means of cure, to collect and destroy the plants that are attacked in order to prevent the spread of the disease. The plant which, though of recent introduction, is already, owing to its flowers, the object of considerable exportation and a not indifferent source of profit to those districts which grow it on a large scale. In Italy its cultivation has been undertaken, especially in Liguria, where it grows very well in the open and acquires its full beauty.

#### PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

**A Poisonous Buttercup (*Ranunculus sceleratus* L.) in New South Wales.** — HAMILTON, A. A. in *The Agricultural Gazette of New South Wales*, Vol. 24, Part. 10, p. 862. Sydney, 1913.

*Ranunculus sceleratus*, described as especially poisonous to cattle, has been found by the writer at Waterloo, N. S. W., in a ditch flowing into Cook's River. It is probably a recent introduction and is not yet very widely spread. It is every prospect, however, of its spreading over a comparatively large area of low-lying marshy land in the neighbourhood of Cook's River. The plant is a freely-seeding annual and occurs under conditions excep-

<sup>1)</sup> See No. 1108, B. Sept. 1913.



tionally favourable for its propagation. These marshes are much used by local dairymen and horse owners for grazing purposes, especially during summer months when other pastures are suffering from lack of moist soil. As far as is known, it has only once previously been recorded in Australia, viz. by Professor Ewart in 1905, near the Snowy River, Victoria.

### INSECT PESTS.

188 - **Life-History of Syrphid Fly Predaceous on Frog hopper Nymph**  
GUFFY, P. L. in *Department of Agriculture, Trinidad and Tobago, Special Circular* No. 8, 5 pp., 3 figs. Trinidad, October 23, 1913.

The writer describes the life-history of a syrphid fly, *Salpingogaster nigra*, which extends over 20  $\frac{1}{2}$  to 21  $\frac{1}{2}$  days. Its larvae attack the nymphs of *Tomaspis saccharina* ("Sugar Cane Frog hopper") and *T. pubescens* ("Tree Frog hopper"). During the larval stage (9 to 10 days) each *Salpingogaster* destroys or sucks from 30 to 40 nymphs of the frog hoppers. There is no doubt that this parasite destroys large numbers of very small larvae wherever the latter are abundant. In two cases the writer found adult frog hoppers which had only just emerged from the nymph stage killed by the larvae of the parasite.

*Salpingogaster nigra* occurs wherever frog hoppers are found. It is one of the most important of the natural enemies of the frog hopper. In its specific parasite, and it is hoped that it may be reared successfully on a large scale.

189 - ***Monolexis lavagnei* n. sp. (Braconidae) parasitic on *Sinoxylon sexdentatum* on Vine Shoots.** — PICARD, F. in *Bulletin de la Société entomologique de France*, 1913, No. 16, pp. 399-402, fig. 1. Paris, 1913.

*Sinoxylon sexdentatum* Oliv. is a Bostrichid beetle commonly found in the South of France on vine shoots, which it destroys. To the natural enemies of this insect already well-known is now added a new species of Braconid, described by the writer as *Monolexis lavagnei*, distinct from *M. foersteri* March. This new Hymenopterous insect is not exclusively parasitic on *S. sexdentatum*; it has been taken from oaks attacked by *Scobicia pusillata* F. and by *Xylomyges praeustus* Germ., and also from Corsican pine (*Pinus Salzmanii* Dun. = *P. Laricio* Poir.), attacked by *Pythogenes* and *Pityophthorus*. The species is probably widely distributed in the South of France.

190 - **Parasites of the Fruit Fly (1) in Africa.** — SILVESTRI, F. in *Estratto dal Bollettino del Laboratorio di zoologia generale e agraria della R. Scuola superiore di Agricoltura in Portici*, Vol. VIII, pp. 164, LXIX figs., 1 Map. Portici, 1913.

In those regions in which fruit growing is an important branch of agriculture and which possess a climate and soil suitable for its extension, much alarm has been felt, especially during the last ten years, at the spread of the fruit fly, *Ceratitis capitata* Wied (2). Whilst some entomologists some

(1) See also No. 1404, B. Dec. 1913.

(2) See B. Dec. 1910, p. 375; No. 2028, B. June 1911; Nos. 3253 and 3281, B. Nov. Dec. 1911; No. 1692, B. Dec. 1912; No. 182, B. Feb. 1913.

(2A)

(2B)

(2C)

special means of control of the injurious insect, others endeavoured to find its parasites and to introduce them into the countries in which they did not yet exist. But the first results obtained were unfavourable and led many to consider that the natural control of *Ceratitis* and other species of the same genus and of the genus *Dacus* was impossible. The question was, however, taken up again in 1910, when the discovery of *Ceratitis capitata* in Hawaii (Honolulu), almost certainly introduced the previous pest with Australian fruit, placed the serious problem before the islanders and obliged the authorities and entomologists to solve it.

The writer was invited by the Hawaiian Government to proceed to Africa in order to seek there the parasites of the fruit fly, as that part of the world had not yet been explored from this point of view, while it was considered as the probable home of the insect. Sig. Silvestri's plan was the following: a) to ascertain by visiting the greatest number of colonies of *C. capitata*, besides being found in the Congo, existed in western Africa, in Senegal and to the south of that region, and if it was controlled by special means which might be advantageously introduced into Hawaii and into Italy (this country also being interested in the question); b) should *C. capitata* not be found, but some other allied species or insects of the genus *Dacus*, seek their parasites and to experiment them on *C. capitata*, and if they gave out promise of success to introduce them into Hawaii and Italy.

The writer left Europe on July 25, 1912, and visited the following localities: the Canaries, Dakar, French Guinea, Senegal, Southern Nigeria, Sierra Leone, the Gold Coast, Dahomey, the Congo, Angola, South Africa, Australia, Honolulu. He returned to Italy, reaching Naples in July 1913. After some notes on the places he had been at and on the entomological researches carried out in each, the writer enumerates the fruit flies observed during his travels: *C. capitata*, *C. giffardii* Bezzi, *C. silvestrii* Bezzi, *C. trita* Bezzi var. *antistictica* Bezzi, *C. punctata* Wied., *C. anomae* Graham, *C. oleae* n. sp., *C. rubivora* Coquillett, *C. nigerrima* Bezzi, *C. trita* Walker, *D. oleae* Gm., *D. armatus* Fabr., *D. bipartitus* Graham, *D. lounsburyi* Coquillett, *D. vertebratus* Bezzi, *D. brevistylus* Bezzi, *D. longistylus* Wied. A systematic description of these flies is accompanied by information on their geographical distribution, host plants, life history, and in the case of *C. capitata* and *D. oleae*, as to the injury caused by them, and artificial and natural means of controlling them.

The writer then gives the systematic description, geographical distribution and life history of the numerous parasites of the species of *Ceratitis* and *Dacus* observed and collected during his journey. They belong to the following families.

a) Braconids: *Opius concolor* Szépl., *O. dacicida* Silv., *O. lounsburyi* n. sp., *O. dexter* n. sp., *O. perproximus* n. sp., *O. perproximus* var. *modestior* n. sp., *O. humilis* n. sp., *O. inconsuetus* n. sp., *O. inquirendus* n. sp., *O. africanus* Szépl., *O. africanus* var. *orientalis* n. var., *Hedylus giffardii* Szépl., *Diachasma fullawayi* n. sp., *D. fullawayi* var. *robustum* n. var., *D. tryoni* Szépl., *Biosteres caudatus* Szépl., *Sigalphus daci* Szépl., *Bracon celer* Szépl.

b) Proctotrupids: *Galesus silvestrii* Kieffer, *G. silvestrii* var. *robustus* n. var., *Trichopria capensis* Kieffer.

c) Chalcids: *Dirhinus giffardii* n. sp., *D. ehrhorni* n. sp., *Spalangia afra* n. sp., *Tetrastichus giffardii* Silv. (1), *T. oxyurus* n. sp.. To these the writer adds *Syntomosphyrum indicum* Silv. (2), as it is a species which may be very useful, at least in tropical countries, and should be introduced into Hawaii.

d) Formicids: *Dorylus affinis* Schuck, *D. (Anomma) nigricans* var. *hybrida* Santschi, *Aeromyrma vorax* Sanstchi.

From the writer's researches the following facts are established:

1) In West Africa various species of *Ceratitis* and *Dacus* exist, some of which, at least in the months in which the writer observed them, were reduced in numbers as to lead one to believe that they were effectively controlled by natural enemies.

2) A certain number of Braconids (of the genera *Opius*, *Diachasma*, *Hedylus*, *Biosteres*), of Chalcids (of the genera *Tetrastichus*, *Spalangia*) and of Proctotrupids (of the genus *Galesus*) are perhaps the most active enemies of fruit flies in West Africa, without however excluding other natural enemies, such as insect egg-parasites, bacteria and fungoid parasites of the larvae.

3) In Nigeria and in Dahomey the writer has ascertained the presence of *C. capitata*; it was however, at least from November to February, extremely rare; this is probably due to the same parasites discovered by the writer for the other species of *Ceratitis* and *Dacus*, without however excluding the possible existence of other enemies.

4) Several hymenopterous parasites of any one species may attack different species of *Ceratitis* and *Dacus*.

5) Parasites of *C. giffardii* and *C. ananæ* were experimented by the writer with *C. capitata* and they developed well.

6) The writer conveyed to Honolulu living adult specimens of *Opius perproximus*, *Dirhinus giffardii*, *Galesus silvestrii* from West Africa; *O. humilis* and *Trichopria capensis* from South Africa, of *Diachasma tryoni* from East Australia; from Honolulu to Portici, Italy, he brought specimens of *Dirhinus* and of *Galesus*.

7) *Dirhinus giffardii* and *Galesus silvestrii* were multiplied and distributed in large numbers at Honolulu, and *Diachasma tryoni* and *Opius humilis* in smaller numbers; in Italy, *Dirhinus* and *Galesus* were distributed.

8) Concerning the results of such distributions nothing can be affirmed until the acclimatization of these species is ascertained; but supposing to succeed, at least in Hawaii, with *Diachasma*, *Opius humilis*, *Dirhinus* and *Galesus*, a considerable destruction of *C. capitata* is to be hoped for.

9) In case *Diachasma tryoni* does not become acclimatized owing to the small number of specimens imported into Hawaii, it will be necessary to import as soon as possible large numbers of them from the

(1) See No. 1404, B. Dec. 1913.

(2) See p. 375 B. Dec. 1910.

the importation of this parasite from Australia to Hawaii being easy. The introduction of other Braconids of the genera *Diachasma*, *Opius*, *Microgaster*, parasites of *Anastrepha*, from Mexico and Central America, is desirable before again attempting the introduction of Braconids from elsewhere because owing to the distance of this country from Hawaii and the fragility of the parasites, their arrival in good condition is very difficult, their introduction into Italy from West Africa is easy.

It is important, and according to the writer even necessary, to introduce *C. capitata* further in West Africa, and to ascertain if it is attacked by *Aspilota* *giffardii*; if so, attempts should be made to introduce this parasite into Hawaii and Italy.

It would also, in the opinion of the writer, be very useful to extend the range of *C. capitata* and other fruit flies in East Africa from Natal to the Cape, because it is possible that other good parasites exist in those

regions. He advises also the importation from India into Hawaii of *Syntormus indicum* and to study the other parasites of the genus *Bactrocera* in India, as among them there might be some very useful for the control of *B. (Dacus) cucurbitae* and some suitable for *C. capitata*.

For the olive fly (*Dacus oleae*) it is necessary in the first place to study the introduction and acclimatisation of *Opius concolor* from Tunis, and other parasites that are already known and others that may be discovered in Eritrea; if these should not afford the desired results, the parasites from South Africa will have to be imported and those which may be found in other parts of Africa and in Asia.

It is of the greatest importance for Italy to study the olive fly in Sicily, where no mischief is reported, and in Eritrea, where many of the parasites of the fly are already known. These researches may perhaps lead to the solution of the grave problem of the control of the olive fly, which would at all events be very useful in extending our knowledge of the history of the fly and of its enemies.

The work ends with a rich bibliography.

**Some Factors affecting the Susceptibility of Cucumber Plants to Burning in Hydrocyanic Acid Gas (1).** — STONE, G. E. in *Annual Report of the Massachusetts Agricultural Experiment Station*, Year 25, No. 31, pp. 61-72 + 1 plate. Boston, January 1923.

Experiments on the fumigation of cucumber plants with hydrocyanic acid gas in glass houses of different illumination gave the following results:

See also *B. Dec.* 1910, p. 382.

(Ed.).

Average of three experiments	Number of compartment			
	1	2	3	4
Relative intensity of light * %	24.40	26.60	48.10	74.00
Average height of plants . . cm	22.30	23.30	17.30	19.90
Average diameter of stem . . »	0.44	0.53	0.53	0.66
Average length of internodes . »	7.30	7.00	5.90	4.30
Length $\times$ width of leaves, sq. cm.	70.90	90.30	62.60	80.20
Effect of fumigation on leaves **	all burnt or killed	burnt, few killed	some only burnt	traces of burning

\* The relative light intensities were determined by chemical methods. The varying light intensities were obtained by means of cloth screens of various grades from mosquito netting to fine mesh.

\*\* All the plants were fumigated with 0.007 gram of cyanide per cubic foot during 1 hour.

Experiments on the effect of varying quantities of soil moisture on the susceptibility of cucumber plants to burning by hydrocyanic acid gas gave the following results :

Average of three experiments	Number of pot				
	1	2	3	4	5
Percentage of moisture * . . .	10.00	15.00	20.00	50.00	60.00
Average height. . . . . cm.	6.20	7.50	10.20	13.00	17.50
Average length of internodes . »	4.20	4.50	5.20	5.50	7.50
Average length of petioles . . »	1.30	1.7	2.2	3.20	4.00
Average diameter of stem . . »	0.30	0.30	0.40	0.45	0.55
Average length $\times$ average width of leaf . . . . sq. cm.	6.25	39.5	67.5	162.50	225.00
Effect of fumigation on leaves **	no burning	no burning	slight burning	nearly all burnt	

\* Percentages of the total water-retaining capacity of the soil, which was 47 per cent.

\*\* Fumigation as before.

These experiments point to the conclusion that differences in the development of the tissues, whether brought about by inferior light conditions

y excessive moisture in the soil, affect their susceptibility to burning  
r the influence of hydrocyanic acid.

Further experiments are being conducted to throw more light on the  
ence of other factors.

***Tapinostola musculosa*, a Noctuid Moth injurious to Cereals in Hungary.** — JABLONOWSKY, JOSEF in *Közelet*, Year 23, No. 99, pp. 3335-3337, pp. 441-443. Budapest, December 24, 1913.

In 1913 a good deal of damage was done to crops of oats and barley  
e Pusztapó estate in Hungary by the caterpillars of *Tapinostola*  
*ulosa* Hb.; some 40 acres were so badly infested that the crops had  
ploughed under.

This species occurs in most of Europe, except the extreme north,  
in Central Asia; it was not previously recorded as injurious in  
ary, though in Russia it has been known to do enormous damage  
me years, as in 1882, 1894 and 1899, when it was estimated that  
birds of the crops were destroyed.

The larvae hibernate in the stubble or in rough grass at the edges  
e fields, so that these places should be ploughed deeply if possible,  
se burnt. Once they reach the grain crops, to which they move  
the end of March, the damage cannot be prevented.

***Anthonomus grandis* var. *thurberleae* (a Cotton-Boll Weevil) on *Thurberia thespesioides*, in Arizona.** — PIERCE, W. DWIGHT, in *Journal of Agricultural Research*, Vol. I, No. 2, pp. 89-98, figs. 1-9, plate VI. Washington, D. C., 1913.

In February, 1913, considerable importance was attached in a prelim-  
report to the discovery of a Curculionid in Arizona (Ventana Canyon,  
Catalina Mountains), resembling the Mexican cotton-boll weevil  
*ononimus grandis* Boh.), whose injurious character is well known. The  
lives in the capsules of *Thurberia thespesioides* A. Gray (syn. *Gossypium*  
*eri* Tod. and *Ingenhauzia triloba* Moç et Sesse), a Malvaceous plant  
mons to Mexico and Arizona, and known by the natives as "wild cot-  
on account of its resemblance to the true cotton plant.

Examination of abundant material from several localities in Arizona  
enabled the writer to distinguish this insect as a new variety of *A.*  
*is*, which he names var. *thurberleae*; it differs from typical *A. grandis* in  
il morphological, physiological and biological characters: the nature of  
st (*Thurberia thespesioides*), its occurrence at higher altitudes (4000 ft)  
he period of its development (mid-August to November). This variety  
fly considerable distances in search of food, though it will probably  
e itself to its natural host as long as there is sufficient of the plant to  
y it with food. Supposing there were a shortage, the insects would  
ally attack cotton first, and with disastrous results. Extensive  
action of *Thurberia* is therefore to be deprecated as tending to encour-  
he insect to adapt itself to the cotton. Thus the writer considers  
ld be better not to interfere with the present conditions, and suggests  
troduction of parasites of *A. grandis* to reduce the numbers of the  
and keep it in check.

194 - *Acheta morio*, an Orthopterous Insect Injurious to Sisal in German East Africa. — KRAENZLIN in *Der Pflanser*, Year IX, No. 11, pp. 568-570. Dar-es-Salaam, November 1913.

The writer has observed on a number of year-old plants in certain parts of a plantation of *Agave rigida* var. *sisalana* a new type of damage not previously recorded on this crop. Portions of the lower leaves about an inch long have been eaten away, sometimes at the tip, but more often at the base, just above the junction with the stem. The damage differed from that caused by snails, which eat the upper surface to a slight depth, in consisting of being cut from the edge of the leaf towards the centre; in some cases whole pieces of the leaf appeared to have been removed and certain leaves were nearly or quite cut off from the stem.

In places where the surface of the ground contained crevices or cracks in the earth, hardly a single plant had been spared. The writer, unable to ascertain the cause of the destruction in the day-time, visited the plantation at night and observed a large number of very small young of *Acheta morio* (Orthoptera) on the damaged parts, for which they were obviously responsible.

The localisation of the insect and its damage is explained by the fact that it only finds a suitable retreat during the day-time in places where the surface of the ground forms hiding-places in which it can live under such conditions even in dry seasons. Such being the case, this insect can become a source of serious danger to the cultivation of sisal.

